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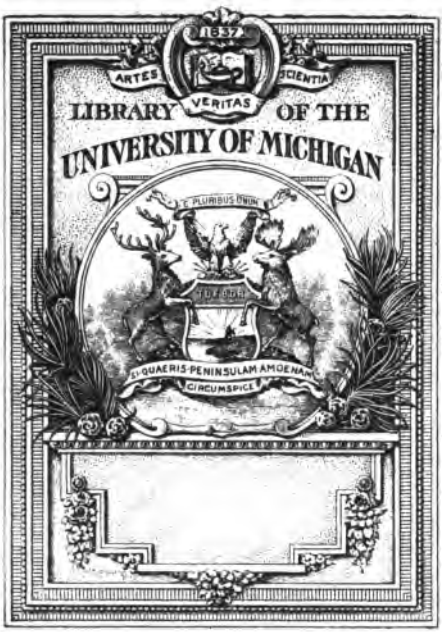
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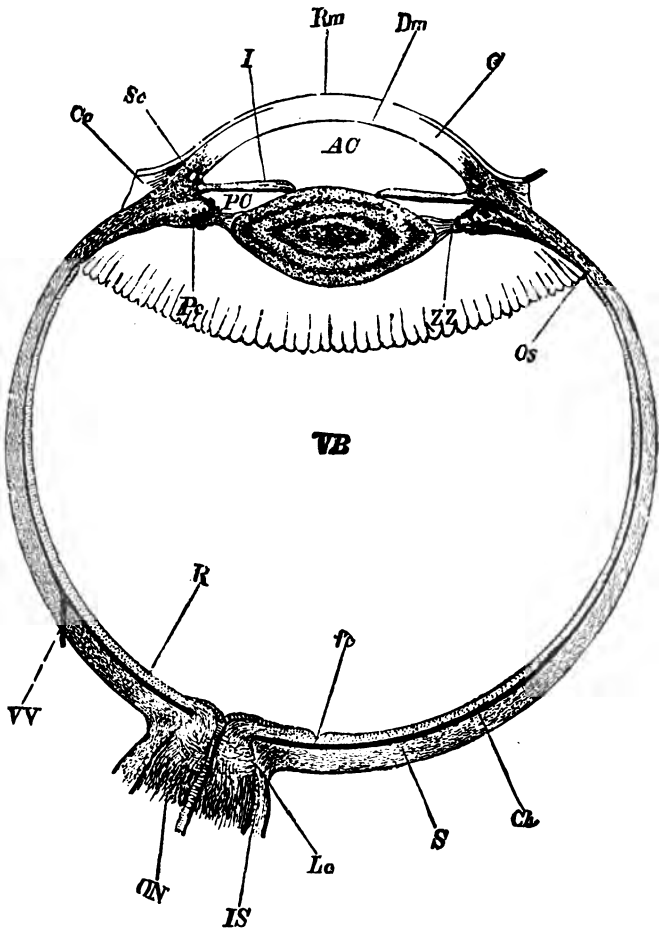

Horizontal section of the right eye.

C, cornea; *Co*, conjunctiva; *Bm*, Bowman's membrane; *Dm*, Decemet's membrane; *I*, iris; *Sc*, canal of Schlemm; *AC*, anterior chamber of the aqueous; *PC*, posterior chamber of the aqueous; *Pc*, ciliary process and ciliary muscle; *ZZ*, zonule of Zinn; *L*, lens; *Os*, ora serrata; *VB*, vitreous body; *R*, retina; *fc*, fovea centralis or macula lutea; *S*, sclera; *VV*, venæ vorticosæ; *ON*, optic nerve; *Lc*, lamina cribrosa; *IS*, intervaginal sheath of optic nerve.

MANUAL

OF THE

ESSENTIALS OF DISEASES

OF THE

EYE AND EAR

—BY—

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WITH ILLUSTRATIONS IN BLACK AND CHROMO-LITHOGRAPH

CHICAGO

GROSS & DELBRIDGE COMPANY

1896

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CHICAGO

PREFACE.

THIS MANUAL, written at the request of the author's classes, presents the essential diagnostic and therapeutic points of the various diseases of the Eye and Ear in such concise form as to enable the student and general practitioner to readily obtain the more important details of the treatment of such diseases.

The anatomy, pathology and refraction have been given as full consideration as possible, consistent with brevity. It is intended that the outlines here given will be supplemented by ophthalmological and otological lectures, clinical and didactic, as well as by reference to the larger text-books pertaining to the subjects.

J. H. BUFFUM, M.D.

VENETIAN BUILDING, CHICAGO.
November, 1895.

THE EYE.

ITS REFRACTION AND DISEASES.

General Anatomy and Physiology.

THE human eye, the visual organ of man, includes in its discussion in a medical or surgical sense not only the globe or eye-ball but also the muscles which control its movements, the eye-lids, the lachrymal apparatus, and those structures—bony, cuticular and nervous—with which it has direct connection.

Has it any other relations beside those mentioned as anatomical?

Its abnormalities, congenital or acquired, may reflect diseases of the brain, spinal cord, kidneys, or other more contiguous structures, cause loss of vision, produce headaches, various neurotic phenomena, and perhaps chorea and epilepsy.

Is the eye to be considered responsible for all the neuroses for which it has been reported to be?

Not in all cases.

Is the eye, even when found abnormal, to be designated always as the cause of the various neuroses which are attributed to it?

No; the abnormality, physical or functional, may be the result of the affection and not the cause.

When is the eye to be considered the cause of near or remote neurotic symptoms?

Only when its optical or muscular defects upon correction cause a disappearance of the symptoms which have been diagnosed as dependent upon those defects.

Is any organ of the body independent of diseases of any other portion?

Possibly so; but the intimate relation which exists between all organs in their circulatory and nervous structure is likely to exhibit the effect of change in one organ upon another, near or distant.

What is the necessity for the presence of two eyes in man?

To enable the human mind to comprehend the idea of solidity without the assistance of the sense of touch.

Where are the eyes located in the human subject?

In two pyramidal cavities, or orbits, in which the eye-balls, with their essential visual portions, are suspended by muscular attachments, cushioned with fat, nerves and blood-vessels and protected from injury by the eye-lids and the hard bony tissue of the orbital margins.

The eye-ball being a very necessary portion of the visual organ, what is its purpose?

To receive and transmit the luminous rays to the retina, that portion of the optic or visual nerve in its interior.

What are the eye-balls, and how are they developed?

The eye-balls are two hollow spheres which grow from the two lateral hollow out-growths which are developed from the lower side of the fore-brain in the

embryo. These lateral evaginations are the *primative optic vesicles* which in their continued growth form the eye-ball with its optic nerve, and thus its direct connection with the brain and spinal cord occurs.

What is the structure of the eye-ball that it can receive and transmit luminous impressions?

The eye-ball is globular or spherical in form, and is really formed by the union of portions of two hollow spheres of different diameter, of which the anterior and more prominent segment is the smaller and made up of transparent tissue called the cornea, while the posterior portion, which comprises five-sixths of the whole, is opaque, white, and named the sclera or sclerotic. In the interior of this hollow ball, less than an inch in its longest diameter, the *antero-posterior* being 24.3 mm. and the *transverse diameter* only 23.6 mm., are found first immediately behind the cornea, a fluid, the *aqueous humor* which fills what is called the *anterior chamber.* A circular muscular curtain which gives color to the eye, brown or blue, next presents itself and is called the *iris;* in it we find a round opening, the *pupil*, and through it we observe behind the iris a small space, the *posterior chamber*, which is also filled with aqueous humor and connected with the anterior chamber and only separated from the latter when the pupillary opening is closed by contraction of the iris or the pupil filled with inflammatory exudation. Behind the iris and the posterior chamber we notice a transparent mass which presents the form of a small circular bi-convex lens, the *crystalline lens*, which is more convex on its posterior surface than on its anterior, and which, when

removed from the eye, looks much like a transparent flattened pea. It is elastic in its structure and its convexity is increased by the relaxation of the membranous structure which incases its fibers and which is continued beyond its periphery in radiating shape to attachment to the *ciliary processes*, and thus we find it suspended in a vertical position separating the anterior and posterior chambers of the eye from the deeper or *fundus* portion. The *ciliary processes* to which we have noticed the attachment of the suspensory ligament of the lens, or *Zonule of Zinn* as it is termed, look like folds or plaits of membrane which might be formed by drawing the "puckering string" of a membranous bag. We find that they rest upon a ring-like mass of tissue, the *ciliary body*, immediately behind and in direct connection with the iris. If the ciliary body is examined histologically we find its structure is abundant in blood-vessels, nerves and pigment cells, and also, like the iris, contains some muscular fibres, which are arranged in the circular shape of sphincter muscles and constitute the *muscle of accommodation*, whose contraction enables the lens to become more convex. As we look beyond the lens into the interior of the eye-ball we find that the space of its hollow interior appears much enlarged and filled with a transparent gelatinous substance, the *vitreous humor*, which like the lens and cornea has no visible blood-vessels, but which in its normal condition has sufficient consistency to give support to those delicate membranes, the *retina* and *choroid*, which line the interior of the eye. The choroid being a loosely meshed membrane made up

almost entirely of blood-vessels of varying size and scattered pigment cells forms the nutrient membrane for the interior structures of the eye, is attached to the sclerotic or outer envelope of the eye and starting from the opening for the optic nerve, at the posterior portion of the eye-ball, is continued forward to the ciliary body, ciliary processes and iris, and forms what is technically called the *uveal tract.* The retina, which is the continuation of the optic nerve within the eye-ball, is applied upon the choroid and supported in its position by the vitreous, and is continued forward to the ciliary processes where it ends in what is termed the *ora serrata.*

How does visual perception take place?

It is known that light rays reflected from an object and falling upon the transparent cornea will pass through it if properly directed and find their way through the aqueous humor, the pupillary opening, the lens and vitreous, and after being subjected to the laws which govern the course of luminous rays through media of varying density come to a focus upon the retina and form an image. The luminous impression thus received upon the retina is transmitted through its continuation, the *optic nerve,* to the ganglionic cells of the optical area of the cortex of the brain, where perception occurs and vision results.

How does the optic nerve connect the eye-ball with the brain and other portions of the nervous system?

In the embryo the primative optic vesicles soon show in their development a constriction which forms

a pedicle and results in the defination of the optic nerve. When the development is complete we find that a secondary optic vesicle is formed, whose distal wall is the retina, and at about the same time, while a cavity still exists in the optic nerve pedicles, fibres are sent out from each and crossing form the *optic chiasm.* If we trace backward the optic nerve fibres from their distribution in the retina, we find that they form the *optic disc* or *papilla* as they leave the eye-ball at its posterior portion and are then enveloped by an inner membrane or sheath which is continuous with the pia mater of the brain and more externally by a dense fibrous sheath which is continuous with the dura mater of the brain. We find, however, that when the optic nerves reach the openings at the posterior portion of the orbits, that they pass through with their pial sheath and that the outer or dural sheath splits up and while continued into the brain cavity also forms the periosteal lining of the orbits. The optic nerves after passing through the foramina optica partially cross in the optic commissure; from the chiasm they are traced backwards in the optic tracts which are found one on each side of the brain crossing the crus cerebri and along the inferior surface of the optic thalami, each tract now dividing into two roots, the external or outer root having its origin in three primary visual centers of the gray matter of the brain, the optic thalamus, the external geniculate body and the anterior tubercles of the corpora quadrigemina. From these ganglia fibres radiate to the cortex of the occipital lobe. The internal or inner root arises from the internal

geniculate body and the posterior tubercles of the corpora quadrigemina.

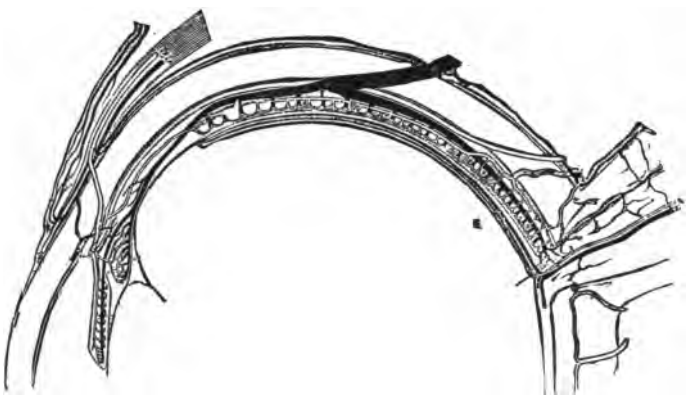
What other nervous connections has the eye and its appendages in addition to those of the optic nerve?

The third nerve supplies the superior, inferior and internal recti, inferior oblique and levator palpebræ muscles with motor impulses. It is joined by the motor nerves of accommodation and sphincter nerves of the iris, which are supposed to have a separate origin in the brain. It also sends a branch to the ciliary ganglion and receives sympathetic filaments from the cavernous sinus. The fourth nerve is the motor nerve of the superior oblique. The sixth nerve is the motor of the external rectus. The ophthalmic division of the fifth nerve supplies the lachrymal gland, conjunctiva and skin of the upper lids and sends a branch to the ciliary ganglion. The sympathetic nerve branches arising from the medulla, cilio-spinal region, cavernous and carotid plexuses join the cranial nerves in their distribution to various portions of the eye. The ciliary or ophthalmic ganglion is located in the back part of the orbit between the optic nerve and external rectus and receives roots from the sympathetic, the nasal branch of the fifth and from the third nerve. It gives off some fifteen or more *ciliary nerves* which pierce the sclera near the optic nerve entrance and pass forward between the choroid and sclera to supply the choroid, ciliary body, iris and cornea.

From what is the blood-supply of the eye derived?

Chiefly from the ophthalmic, a branch of the internal carotid, which sends arteries to the eye-ball and its

appendages. The infra-orbital, a branch from the internal maxillary of the external carotid, supplies the

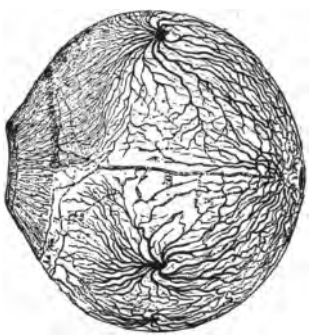


Blood supply of the eye-ball: *aa*, posterior ciliary arteries. *b*, long ciliary arteries. *c*, anterior ciliary arteries. *e*, central artery of retina.

inferior rectus and inferior oblique muscles and lachrymal gland. The anterior cerebral sends some capillaries to the optic nerve. In the eye-ball there are two systems of blood-vessels for the supply of the interior structures, that of the retina which comes from the central artery of the retina and supplies the retina and optic nerve, and the choroidal which comes from the ciliary arteries which enter around the optic nerve and supply the choroid, ciliary body and iris, sclerotic, margin of the cornea and part of the conjunctiva of the ball. The only connection between these two systems is by means of small twigs around the optic nerve entrance.

What is to be said of the veins of the eye?

They follow in general the course of the arteries and form two main trunks, *superior* and *inferior ophthalmic*,



The arrangement of the choroidal veins forming the venæ vorticosæ.

which run along the roof and floor of the orbit to empty into the cavernous sinus. In the choroid the veins show a wheel-like arrangement, the *venæ vorticosæ*, and converge to about four principal trunks which pierce the sclerotic very obliquely about half way between the optic nerve and cornea to join the ophthalmic vein.

How are the cornea, lens and vitreous, which have no direct blood supply, nourished?

The cornea has at its margin a fringe of capillaries which discharge their nutrient fluid into an extensive system of lymph canals in its substance through which the plasma circulates in all directions. The lens has no direct blood supply, but under that portion of the membrane which covers its anterior portion, the *anterior capsule*, there is a single layer of hexagonal

transparent granular-looking epithelial cells each with an oval or spherical neucleus from which the lens fibres are probably derived and which governs the nutrition of the lens by promoting proper osmosis between the lens tissue and the lymph in the anterior chamber. The ciliary processes, which secrete the aqueous humor, owing to their close proximity to the edge of the lens undoubtedly assist materially in the nutritive function. The ciliary processes with the aid of the capillary layer of the choroid supply the vitreous with its nourishment.

What are the lymphatics of the eye?

There exist in the eye three distinct lymphatic systems, The *anterior system* being formed by the canal of Petit (a circular canal or space formed by the separation of the fibres of the suspensory ligament of the lens between its attachment to edge of the lens and to the ciliary processes), the aqueous chamber (the space between the posterior layer of the cornea and the anterior capsule of the lens), the spaces of Fontana (openings in the mesh work of the ligamentum pectinatum or comb-shaped ligament which unites the iris and anterior portion of the ciliary body by elastic fibres to the sclerotic immediately behind its junction with the cornea); these spaces open into the canal of Schlemm, a flattened circular canal in the sclerotic near the margin of the cornea.

The lymph secreted by the ciliary processes travels to the aqueous chamber by three channels. A large portion passes to the vitreous humor and canal of Petit, then through the suspensory ligament of the lens for-

ward through the pupil to the aqueous chamber; another portion passes directly into the posterior chamber back of the iris and then through the pupil into the anterior chamber, while a third current passes from the ciliary processes through the tissue of the base of the iris directly into the aqueous chamber. The aqueous thus formed leaves the chamber at the angle formed by the iris and cornea through the spaces of Fontana into the canal of Schlemm and then into the veins in that vicinity to find its way to the veins of the choroid.

The posterior lymphatic spaces are those of the choroid and sclerotic and those of the retina and optic nerve. The lymph formed in the posterior portions of the eye escaping through channels around the trunks of the venæ vorticosæ into the lymph spaces of the capsule of Tenon and through the sheaths of the blood-vessels of the retina to the optic nerve, thence through the lymph spaces between its sheaths to the sub-dural space of the brain.

How are the movements of the eye-ball effected?

The eye is moved by six muscles, four recti and two oblique. Of these the internal, external, superior and inferior recti as well as the superior oblique take their origin from the apex of the orbit around the canal is opticus. The inferior oblique muscle comes from the inner margin of the lachrymal canal. The recti muscles are inserted upon the sclerotic at slightly different distances from the sclero-corneal margin. The oblique muscles are inserted in the sclerotic at a much greater distance from the cornea and on the outer side of the ball. These muscles may act singly

or in various combinations to produce the motions of the eye in all directions. The muscles of both eyes act in harmony and the movements are either associated, the visual lines being parallel, or accommodative, the visual lines being convergent.

What are the appendages of the eye?

The eye-brows, which are arched elevations of skin above the orbits and covered with rows of short hairs, which serve to protect the eyes to some extent and also modify slightly the light admitted to the eyes.

The eye-lids, which are two movable protecting folds placed before the eyes and closing the entrance to the orbit, presenting also at their free margins two rows of stiff hairs, the cilia or eye-lashes.

The caruncula lachrymalis, which is a small, red, fleshy body resting upon the semi-lunar fold of the conjunctiva at the inner canthus.

The lachrymal apparatus, which consists of the lachrymal gland and the excretory ducts, the lachrymal sac and nasal duct.

What is an optical memory picture?

A more or less permanent impression made upon the memory cells in the ganglionic optical area of the cortex of the brain by the transmitted retinal excitation which occurs as the result of the formation of an image upon the retina.

What is necessary for the formation of these pictures?

That the eye-ball be in proper position to receive the rays of light from an object placed in front of it, and that the cornea, aqueous, pupil, lens and vitreous

are normally clear and that these refractive media are of such a character as to change the course of the light-rays so as to form a perfect image of the object upon the retina. That the retina and optic nerve be in proper condition to receive and transmit to the brain cortex the stimulus formed by the impression made by the image upon the retina. Lastly, that the brain shall possess a normal development and condition when the stimulus thus reaches it, that the memory cells of the optical area of the cortex be properly excited so that perception of the object ensues.

Methods of Examination.

The examination of the eye may be accomplished in several ways: first, by the unaided eye, as by direct inspection; second, by the aid of focal or oblique illumination; third, by the use of the ophthalmoscope; fourth, by the manipulation of the parts; fifth, by tho use of the proper tests designed for the purpose of ascertaining the acuteness of vision and the perception of color, the extent of the field of vision as well as the power and range of that physical function of the eye called the accommodation. With skill in the use of these methods of examination, the physical and functional condition of the eye in health or disease may be determined with the greatest scientific accuracy.

Is it wise to ascertain the previous history of any disease or injury of an eye, which is presented for examination or treatment?

Heredity and a knowledge of the former physical condition of the individual as well as the circumstances

which produced the disease or injury of the eye are of the greatest value often in making a diagnosis or prognosis.

What may be learned from observation of the patient's general appearance?

A glance at the patient's bearing and appearance may enable one to decide in some cases upon the part affected and have the diagnosis confirmed by further examination. In loss of vision from retinal or optic nerve affections the head is carried well up and eyes open; the cataract patient shades the eyes with the hand, advancing timidly. The astigmatic individual carries the head to one side or with lids half closed, as in myopia, or with the head bent forward and eyes directed upward to the eye-brows, as in paralysis of the superior oblique muscle, where vertigo follows the attempt to look downwards. The half closed eyes of one suffering from ptosis, or the trachomatous patient with his heavy lids, or again the patient suffering from some corneal or conjunctival affection where great photophobia requires exclusion of light by lid closure, may indicate the part affected and the probable diseased condition.

What procedure is followed in a detailed examination?

The patient is either seated before a window admitting a clear but not too bright sunlight, or before a sufficient artificial illumination; the surgeon stands to one side, or if necessary to confine the head of the patient, it is supported against the chest of the surgeon, who then stands behind. If the light is sufficient a careful examination of all the external parts of the eye which may be affected is made.

What is focal or oblique illumination?

A method of examination by which the rays of light, ei her natural or artificial, are condensed by a biconvex lens of 2 inches or 18 dioptres in such a manner that the focal point of the rays is so directed as to fall upon that portion of the tissues of the eye which is under examination.

What can be accomplished with focal illumination?

The determination of the normal or abnormal condition of all the tissues of the anterior portions of the eye, such as that of the sclerotic, the transparency or opacity of the cornea and the condition of the aqueous. The presence of foreign bodies upon or in the anterior portions of the eye-ball. Changes in the iris or pupil. Deposits on the anterior portion of the lens as well as its transparency or opacity. The presence of pus or the projection of tumors in the vitreous when they are in contact with the posterior portion of the lens.

How is the examination to be accomplished when from fear, pain, photophobia with spasm of the lids or disease, the eye-ball is excluded from view by the closure of the lids?

In the adult by the use of a 2 or 4 per cent. solution of cocain muriate which has been instilled into the eye a drop at a time at intervals of two or three minutes for several instillations, when the lids may be separated usually without difficulty. In children, and in rare cases in adults, it may be necessary to employ some general anesthetic, so that complete examination may be made without unnecessary pain and without danger of injury of the eye-ball from undue compression.

In the infant or young child it may be necessary to

secure the head of the child between the knees of the surgeon or examiner while the body and limbs are held in the lap of the attendant; then the eye-lids may be carefully separated with the fingers, withdrawing the upper lid by traction made over the brow with the thumb and fingers of one hand while the lower lid is drawn downward by the fingers of the other hand. In some cases, owing to the swelling of the lids, a metallic retractor or elevator of the lid is necessary, which should be carefully introduced so as to avoid as far as possible any pressure upon the eye-ball and at the same time expose the cornea and sclerotic to view.

In the examination with the unaided eye what may be gleaned from simple inspection?

The presence or absence of the eye, as well as any congenital defects or injuries of its external portions or appendages. Diseases of the lids, lachrymal apparatus, conjunctiva, cornea, iris, lens, orbit, and often of the surrounding cavities. Affections of the muscles and even probable or gross errors of refraction.

In a general survey what may be determined by a comparison of the two eyes?

Whether one or both eyes are affected, the presence or absence of squint, or loss of mobility of one or both eyes from paralysis of the muscles or unequal prominence of the eyes.

What does prominence of the eye-balls indicate?

Either a family trait, myopia, light cases of Basedow's disease, or some increase in the contents of the eye-ball, orbit, or surrounding cavities.

What does protrusion of the eye-ball indicate?

With protrusion of the eye-ball there is either complete or partial loss of motion of the eye-ball, and the protrusion or exophthalmos is due to disease of the contents of the orbit, or its bony enclosure, to tumors within the eye, the orbit or the surrounding cavities, and is also a marked symptom of exophthalmic goitre or Basedow's disease.

What is to be noticed as regards the condition of the eye-lids?

Wounds, scars, loss of motion as in ptosis, or inability to close them as in facial paralysis, inversion or eversion of their margins, the condition of the cilia, their irregularity, distribution or loss should be observed. The lid margins, whether normal in color and thickness, or red, ulcerated and thickened; and the presence or absence of tumors, swellings, or styes.

In addition to the inspection of the external portions of the eye-lid, what further should be done in its examination?

The lid should be everted to determine the presence of a foreign body which may have found lodgment thereon, and to ascertain the condition of its conjunctival surface.

How are the eye-lids to be everted?

The lower lid is readily everted by drawing down the skin of the face with the thumb or finger placed at the lower margin of the orbit, and at the same time having the patient look up.

The upper lid in its eversion requires care and skill for its accomplishment without discomfort to the patient. Catch the eye-lashes or the edge of the lid

between the finger and thumb and draw it away from the globe, at the same time direct the patient to look downward, while with the third finger, or a probe-like instrument in the other hand, catch the upper border of the tarsus and press it down when the lid in its normal condition is readily everted by folding upon itself.

What does a hyperemic or injected appearance of the eye-ball indicate?

That the conjunctiva of the eye-ball is suffering from an irritation produced by the presence of a foreign body or an inflammation of its structure due to injury, disease or surgical operation, or inflammation of its continuation in the lachrymal sac, duct and the nasal mucous membrane.

What does the deeper and more intense congestion of the eye-ball indicate?

An inflammation of the conjunctiva, cornea, iris, sclera, or of the interior structures.

If there is a discharge from the eye, what is its significance?

If only watery, it is due to irritation of the eye from the presence of a foreign body, a superficial abrasion or ulceration of the cornea, an inflammation of the iris, or an obstruction in the lachrymal ducts. If mucoid in character, a catarrhal inflammation of the conjunctiva is present. If muco-purulent, an inflammation of the conjunctiva of a higher type is indicated If purulent, an intense inflammation of the conjunctiva, cornea or eye-ball is to be diagnosed.

When there is a tumor-like swelling on the side of the nose, which on compression causes a flow of fluid, clear or purulent, into the conjunctival sac, what is its diagnostic value?

It indicates a stricture of the lachrymal duct with distension of the lachrymal sac if the fluid is clear, and an inflammation of the sac if the discharge is purulent.

What is to be noticed as regards the iris?

Any marked variation in the color of the iris or size of the pupil by comparison with that of the other eye, and whether there is an injection of the sclerotic at the margin of the cornea which may indicate an inflammation of the iris.

What is to be observed as regards the pupil?

Whether it contracts when exposed to light and dilates when shaded, and whether the opening appears black, round or irregular.

What is the danger in the manipulation of the lids in the examination of the eye-ball?

Undue pressure upon the lids or eye-ball in their examination may cause a rupture of the cornea and loss of a portion of the contents of the eye-ball, when there is a weakened condition of the cornea from inflammation, ulceration, or suppuration.

How is the tension of the eye-ball determined?

By the manipulation of the eye-ball through the lids when they are gently closed and when the patient has turned the eye down under the direction of the surgeon, who, with the fore or middle finger of each hand, applies alternate pressure upon the closed eye-lid, as in palpation, and finds that the resistance following

is greater or less than that of the other eye or by comparison with one of his own which is supposedly normal.

When the eye-ball appears harder under manipulation than the normal, what does it indicate?

A glaucomatous condition, the secretion being greater than the excretion.

When the eye-ball feels softer than the normal, what are the conditions likely to produce it?

Ruptures of the eye-ball, detachment of the retina or phthisis bulbi.

Has the character and location of the pain which may be described by the patient, any particular significance or value in forming a diagnosis of the part affected?

Yes; both are of great importance in determining the probable lesion.

What is necessary for the purpose of determining the acuteness of vision?

A good light and standard test-types.

When only light is distinguished, how is the vision to be recorded?

As quantitative, the eye under examination having only the power to distinguish between light and dark, as when the hand is passed before the eye so as to cut off the light or again allow it to fall upon it. If the color and kind of light are perceived the vision is qualitative.

May not the individual be able to see something and yet not be possessed of sufficient vision to distinguish large letters?

Yes; fingers may be counted by the patient a few

inches or more from the eye, and the distance at which they are counted is to be recorded.

When are test-types of use?

When the largest letter of the test-type is seen at a distance of twenty feet.

Why at twenty feet?

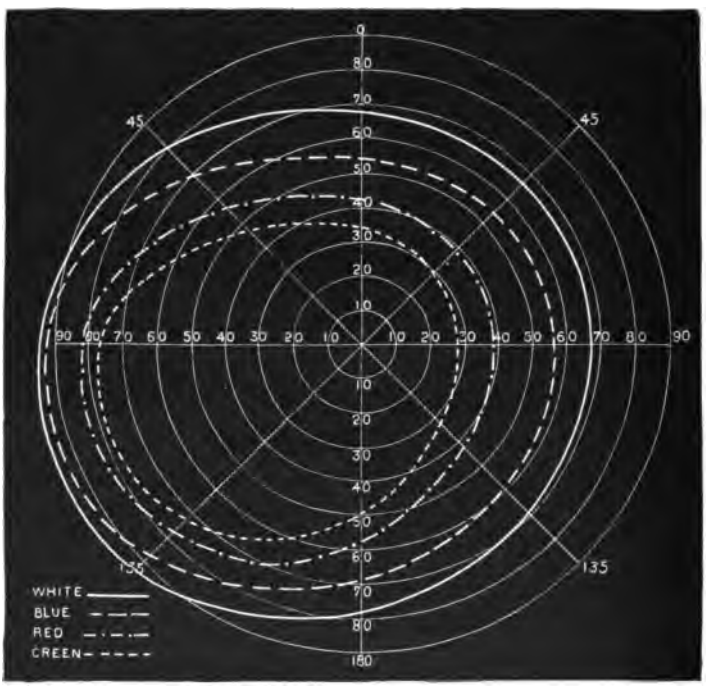
Because the test-types are constructed upon a mathematical scale in accordance with the average visual power of the normal eye, so that a letter of certain size should be seen at a distance of six metres or twenty feet, as then the rays of light coming from it are virtually parallel.

How is the vision of patients under examination to be recorded?

According to the ability of each eye when tested separately to see light or objects. If only light from dark is distinguished, the vision is noted as quantitative, the sense of form being absent. If the fingers can be counted and letters of the test-type cannot be distinguished, the distance from the eye at which they are counted is recorded, and it is understood that the form sense is only partial. When the test-types are visible the distance measure of the letter or line of letters which is seen forms the denominator of a fraction of which the numerator is the distance in feet or metres at which, if the vision is normal or the form sense perfect, it should be seen. If the sight is perfect the record would read $\frac{20}{20}$, if defective, from $\frac{20}{200}$ through the various lines $\frac{20}{100}$, $\frac{20}{70}$, $\frac{20}{50}$, $\frac{20}{40}$, $\frac{20}{30}$, to $\frac{20}{20}$.

What is the field of vision?

The area over which objects may be distinguished, while the eye is kept fixed on some one point.



Normal visual field (left eye).

What is the necessity of determining the extent of the visual field?

To determine the extent of the influence of a disease process on the vision, and as an aid to the location of the lesion in certain forms of disease which affect the vision. Its contraction for white or colored objects gives

reliable information of the progress of disease in cases of atrophy of the optic nerve and retina, and valuable suggestions regarding the time and propriety for operation in glaucoma.

How is the extent of the field of vision determined?

By seating the patient before a blackboard with a white dot in the center so that the eye to be tested is about twelve inches from the surface of the board and in a line with the center, then, having closed or covered the other eye, the eye to be examined is directed upon the dot in the center of the board. Then the surgeon slowly projects a small white object along the surface of the blackboard from the temporal side of the patient until he perceives it, when a mark is made upon the board at that point. In this way the object is carried in a circle around the center of fixation, marking the most extreme points which the patient is able to see, while his vision is concentrated upon the dot. Lines connecting the various points thus made upon the blackboard form the boundary which encloses the field of vision.

The field of vision may be roughly taken by having the patient close one eye and with the other look at a button upon the coat of the surgeon, who stands in front of him; the fingers or an object held in them then describe the circle which is mentally registered by the examiner as forming the limits of the field of vision of the patient. For scientific accuracy use is made of the perimeter, an ingenious instrument especially designed for the purpose.

What is a scotoma?

A scotoma is a blind spot in the field of vision, and is a symptom indicative of either a loss of function of a portion of the retina or optic nerve dependent upon disease of these structures, or it may result from a central lesion.

When does a positive scotoma occur?

When there is complete loss of the perception of white light in that portion of the field of vision opposite the affected spot of the retina which appears dark.

When does a negative scotoma occur?

When there is perception for white light, but colored lights, as red for example, are not perceived.

What physiological scotoma is normally present?

The so-called blind spot which results from the absence of perceptive elements in the optic disc.

How is the color sense examined?

First, by the use of colored objects, such as blue, red and green. The color field being mapped out by the perimeter in the same manner as when used for the determination of the visual field with white, the field for each color being determined separately.

Second, by the use of colored worsteds, representing the primary colors and their shades. The ability or inability of the individual under examination to match various shades of the worsteds, as presented in the Holmgren test, determines his normal color perception, or his color-blindness for certain colors. For example, if he is color-blind for red, a rose-purple colored mass of wool being taken for the test color, blue and violet

are chosen as the shades which appear to him to match the test-color, instead of those colors which contain a preponderance of the red.

What is meant by the accommodation of the eye?

By accommodation is meant that power which the eye possesses of altering the condition of its refractive media, so as to form upon the retina images of near objects, the rays of light from which are divergent, equally distinct as images of more distant ones, the rays of light from which are parallel or nearly so.

How is the act of accommodation accomplished?

The crystalline lens is composed of a somewhat elastic substance and suspended in a vertical position

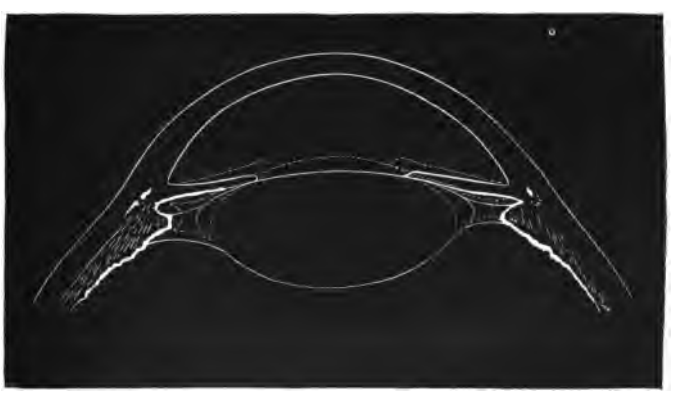


Diagram illustrating accommodation.

by a circular membraneous ligament which is stretched tightly across the eye with an attachment at its periphery to the ciliary processes and at its inner portion to the edge of the lens. The tension of this membrane in

the normal eye keeps the lens in a more flattened state than it would assume if the membrane was relaxed. The ciliary, a sphincter muscle which we have noticed imbedded in the ciliary body, when brought into action relaxes the suspensory ligament of the lens and enables it to become more convex, particularly on its anterior surface. This change in the shape of the lens increases its power for the convergence of divergent rays of light.

In the act of accommodation what else occurs besides this change in the shape of the lens?

The eye is converged or turned inward by the action of the internal rectus and the iris also contracts so as to cut off the more divergent portion of the light-rays by making the pupil smaller.

What is understood by the term amplitude of the accommodation?

The total power of any eye to change the direction of the light-rays during the act of accommodation.

What is the range of the accommodation?

The distance between the most remote point at which a perfect image is formed upon the retina and that of the most near point at which a distinct image is formed by the exercise of the accommodation.

What affects the range of the accommodation?

As age advances the lens loses part of its elasticity and the near point of distinct vision is gradually removed farther from the eye. From infancy to ten years of age, for example, the accommodation is so powerful that objects are distinctly seen at from two to

three inches from the eye. At forty the near point has receded to seven or ten inches, after which the recession is more rapid, until at seventy-five or eighty the accommodation is completely lost.

May this change in the range of accommodation occur from other causes than the physiological one due to age?

Yes; certain drugs may paralyze the power of accommodation, or the advent of diseased conditions within the eye or brain may disturb or destroy its function.

The Ophthalmoscope.

In the examination of the interior of the eye beyond the lens what instrument is necessary?

An ophthalmoscope.

Why is an ophthalmoscope necessary?

Because the rays of light which enter the eye leave it in the same direction which they took upon entering. In the effort to look into an eye with the unaided eye of the examiner there is not sufficient light reflected from his own eye into that of the eye under examination, and the position of his head prevents the admission of light from other sources to enter the observed eye; hence the pupil of the latter appears black, and no view of the fundus or interior is obtained.

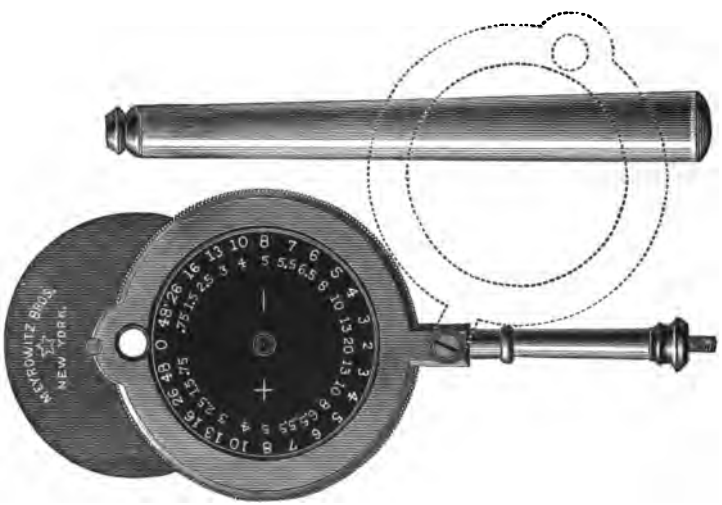
What is an ophthalmoscope?

A circular mirror with an aperture in its center, which, while reflecting the rays of light from an illuminating source into the eye under examination, allows

some of the returning rays of light to pass through the opening into the eye of the observer which is placed behind it.

When was the ophthalmoscope invented and by whom?

In 1851, by Helmholtz, whose original instrument consisted of three parallel plates of glass slightly separated and held at an angle so that the light from a candle was reflected into the eye under examination, and



The Loring ophthalmoscope.

on the return of the light from it, a portion of the rays passed through the transparent glass and was focused in his own eye, so that he obtained an image of the interior or fundus of the eye examined.

Is there more than one kind of ophthalmoscope?

There is a great variety, from a simple circular

mirror with an aperture in its center to those complex instruments used in determining the refraction of the eye as well as the condition of the fundus, and also ophthalmoscopes which carry their own electric illumination upon the instrument.

Is there more than one method of procedure in the examination of the eye with the ophthalmoscope?

Yes. There are two; termed the direct and the indirect methods.

How are you to proceed in the effort to examine the interior of the eye in the direct method?

The observer sits or stands in front of the patient in such a manner as to enable him to use his right eye for the examination of the patient's right, and his left eye for the patient's left. The light which is to be reflected by the ophthalmoscopic mirror is placed at the side of the eye to be examined, a little behind and on a level with the patient's ear. The mirror of the ophthalmoscope is now held as close to the eye as possible and yet reflect the light into it, and with the eye of the examiner behind it, the observer looks for the complete illumination of the fundus as shown by the red reflex which is presented and then for the optic disc, and then examines the other portions of the eye at his leisure, the images which he views being in their normal or upright position.

What is the difficulty experienced with this method of examination?

The accommodation of both the patient and the observer should be relaxed or in a state of rest.

What can be gained in this method of examination beside views of the interior of the eye?

The refraction of the eye may be determined under proper circumstances, as when the observer has relaxed his accommodation and corrected any error of refraction which his own eye may present by a proper lens placed immediately behind the mirror, and, the patient's accommodation being relaxed, a series of lenses in the ophthalmoscope is rotated in front of the observer's eye until, if the picture of the disc is not already distinct, as when the observed eye is normal, it becomes so, the lens required to make it distinct being the measure of the patient's refractive error.

How is the examination made in the indirect method?

The patient stands or is seated before the observer with the light above or to one side of the patient's head, the ophthalmoscope is held eighteen inches to two feet from the patient and in front of the observer's eye, at the same time a convex lens is held within less than two inches of the eye and through which the rays of light are reflected from the ophthalmoscopic mirror into the observed eye. The rays emerging from the eye again pass through the convex lens and are brought to a focus in the air between the lens and the ophthalmoscope, forming there an inverted image of the interior of the eye.

Can this method be used in determining the refraction of the eye?

Yes; but only for the purpose of discovering the gross errors which may be present.

The Normal fundus.

Having learned to recognize the optic nerve with the ophthalmoscope, what further is to be studied?

The retinal vessels and their distribution as well as the condition of the retina and choroid, after a knowledge of their normal appearance has been acquired. Changes from the normal being quickly detected when skill in the use of the ophthalmoscope has been obtained.

Are there any other methods of examination of the eye in addition to those already discussed?

Yes, numerous other instruments have been devised, and also many methods invented to aid in the examination of the eye, all of which possess merit.

What two are worthy of mention here?

The method known as keratoscopy or shadow-test, and that of ophthalmometry.

What is meant by keratoscopy?

A method of examination of the refraction of the eye which was discovered by Cuignet in 1873, and so named by him in the absence of the knowledge of the principle involved.

Later investigation determined the fact that the term did not properly describe the method employed, so that the method has been variously described since as keratoscopy, pupilloscopy, keroscopy, retinoscopy, skiascopy and shadow-test. The method consists of the examination of the motion of a shadow in normal and abnormal eyes, produced by the reflection of light-rays into the eye with a plane or concave mirror, which, when the latter is rotated upon its vertical axis, gives back from its reflected rays on their return a light spot

surrounded by a shadow which moves with the mirror, or in the opposite direction, depending upon the condition of refraction of the eye. The shadow, being more readily seen than the light-rays, forms the basis of observation and its behavior in the examination of the refraction of the eye, when in addition to a simple examination of the motion of the shadow the method is supplemented by the aid of lenses placed before the patient's eye, as is described in the notes on refraction, enables us to determine and measure the error of refraction fairly accurately.

What is ophthalmometry?

An auxiliary method devised through the invention of instruments by Helmholtz, Javal and Shiötz, and others, which enables us to measure the radius of curvature of the cornea, and so determine by the proper and skilled use of these instruments the degree of variation in the curvature of the different meridians of the cornea; thus the observer is able to accurately measure the refraction of the cornea in its meridians and diagnose the presence or absence of corneal astigmatism.

The Refraction of the Eye and Errors of Refraction.

The eye-ball, in its normal condition, presents an imperfect optical instrument if we consider its refracting media alone, but when in addition to this refracting media we consider that adjunct furnished by the muscle

of accommodation by which the refractive power is increased automatically, we have an organ which in its perfect development far surpasses in utility any optical instrument of the most perfect make. Eyes, however, are susceptible to those laws of heredity and circumstance which may affect their development in common with that of other organs, and we more often have to consider the defective or diseased organ, than that which presents a normal construction and function.

What is a refracting medium?

Any transparent substance which changes the direction of the rays of light which pass through it.

What is a dioptric medium?

Any transparent substance through which light may pass.

What is refraction?

Refraction is the deviation in direction which luminous rays experience when passing obliquely from one medium to another of different density.

What is a ray of light?

A single beam or line of light which emanates from a luminous point. A collection of rays is called a pencil of light.

State the law of refraction which governs the passage of a ray of light from one transparent medium into another of different density?

A ray of light is refracted toward the perpendicular of the denser medium when entering in an oblique direction to its surface. The reverse is true when a ray

of light passes from a denser into a rarer medium under the same conditions regarding direction.

What is a prism?

Any transparent medium comprised between two plane faces inclined to each other.

How is light refracted in passing through a prism?

It is always refracted towards the base of the prism in a degree according to the size of its refracting angle and the index of refraction of its substance.

What is meant by incident and refracted rays?

An incident ray is one that impinges upon the surface of a refractive medium; while a refracted ray is one which has undergone the deviation consequent upon its refraction in passing through the medium.

What is meant by the term index of refraction?

This term is applied to the number which indicates the relative power of a medium to bend the rays of light passing through it away from the direction in which they entered it, when compared with that of the air which is taken as a standard and has an index of 1.

What are lenses?

Lenses are transparent media which from the curvature of their surfaces have the property of causing luminous rays which transverse them either to converge or diverge. According to their curvature they are either spherical, cylindrical, elliptical or parabolic.

What is a convex spherical lens?

One that is thickest at the center and has a convex

surface on one or both sides. It is indicated by the sign +.

What is a concave spherical lens?

One that is thinnest at the center and has a concave surface on one or both sides. It is indicated by the sign —.

Name the different forms of lenses?

Biconvex, biconcave, plano-convex, plano-concave, converging meniscus, diverging meniscus, cylindrical and sphero-cylindrical.

How does a convex lens refract the light when passing through it?

The rays of light which pass in a direction other than the axis are affected as by prisms with the base to the optical center, and are turned toward the optical center so that they are brought to a focus at a distance behind the lens equal to its measure.

How may lenses be regarded?

They may be regarded as composed of a series of prisms which in convex lenses are placed with bases toward the optical center, and in concave lenses in the opposite direction.

What are the centers of curvature of a lens?

In lenses whose two surfaces are spherical, the centers for the surfaces are called centers of curvature.

What is the principal axis of a lens?

It is a straight line which passes through the centers of curvature in the direction of which a ray of light is not changed.

What are the secondary axes of a lens?

Any lines which pass through the optical center of the lens other than the principal axis is a secondary axis, and the light-ray is also practically not changed in direction.

What is the action of a biconvex lens?

From a luminous point or body, rays of light issue in all directions, therefore such rays must be divergent. But for practical purposes rays coming from an infinite distance or proceeding from a point twenty feet distant are called parallel. Such rays passing through a biconvex lens are converged to a point behind it called the principal focus.

What action has a biconcave lens?

Such a lens renders parallel rays divergent. The focus of their supposed prolongation backward is called the negative focus of the lens, and is situated in front of the lens.

Where is the optical center of a lens?

It is that point upon the principal axis through which all secondary axes pass after entering the lens.

What is meant by the focus of a lens?

It is the point where the refracted rays meet after passing through the lens or when their prolongations backward come together in front of the lens, the principal focus being the point at which parallel rays entering the lens are brought to a focus, as in a convex lens. In a concave lens the focus is virtual or imaginary.

What is the focal distance of a lens?

It is the distance between its optical center and the principal focus.

What are the conjugate foci of a lens?

Any two points in relation to the lens at which, if the object is placed at one point, the light-rays emanating from it after passing through the lens meet and form an image at the other.

What determines the strength of a lens?

Its degree of refracting power.

How are they numbered?

By their focal distance. The dioptric system is based on the dioptre, a French unit, which is equivalent to a lens whose focal distance is one metre or about 39.4 inches in length. Thus a lens of one metre focal distance is called a lens of one dioptre or 1 D.

The inch system is based on the English inch as a unit of focal distance, the strength of the lens being expressed by a fraction whose numerator is 1, and whose denominator is the focal distance of the lens; a lens of about 40 inches focal length being designated as $\frac{1}{40}$, or 1 dioptre or 1 D.

What are trial glasses?

These are sets of lenses, two of each kind, composed of sphericals and cylindricals which range from a quarter to twenty dioptres and are used to test the vision and for the purpose of determining the appropriate glass with which to measure or correct anomalies of refraction.

What is a cylindrical lens?

A lens, one or both surfaces of which are portions of the surface of a cylinder.

How does it differ from other lenses?

By having a surface which refracts the light only in a direction at right angles to its axis.

What constitutes the dioptric system of the eye?

The cornea, aqueous humor, crystalline lens, and vitreous humor. Their refractive indices are, of the cornea, 1.377; aqueous humor, 1.337; the average of the lens, 1.454; and that of the vitreous, 1.338.

What is the principal focal distance of the eye?

About 22.2 mm.

What is requisite for distinct vision?

Perfect transparency of the dioptric media, regularity in the curvature of its surfaces, and that the location of the retina corresponds with the principal focal plane and that the retina, optic nerve, and visual sphere of the brain be in perfect functional condition.

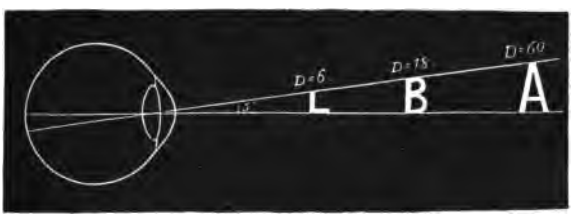
What is the macula lutea or fovea centralis?

The point of most acute vision in the eye, situated on the temporal side of the optic nerve entrance at a distance of about twice the diameter of the optic disc and a little below; the fovea being distinguished from other portions of the retina by the absence of visible blood vessels, and its position in regard to the optic disc.

How is the acuteness of vision determined?

By comparison with standard tests which correspond to the normal perfect vision.

Test cards, as devised by Snellen, Jaeger and others, are so arranged with letters thereon of different sizes which should be readily seen in a good light at certain distances. The letters of Snellen are so constructed that the smallest letters are contained in a square the sides of which are 9 mm., and when placed at a distance of 6 metres are seen at an angle of five minutes, while each limb of the letter is about one-fifth of its width, and therefore seen under an angle of one minute. It has



Visual angle of five minutes.

been found that this is the smallest angle under which the majority of healthy eyes can recognize an object. The patient being placed at a distance of twenty feet or six metres in front of and facing the card which is hung in a good light, if he reads the letters of the row which should be seen at this distance he may be said to have normal acuteness of vision, and his vision is recorded as $V=\frac{20}{20}$, or $V=\frac{6}{6}$, or $V=1$.

What is meant by divergent, parallel and convergent rays?

Light is propagated from a luminous point in every plane and in every direction in straight lines; these lines of direction are called rays. Rays of light diverge, and the amount of divergence is inversely pro-

portionate to the distance of the point from which they come; the nearer the source of the rays the more they diverge. Rays proceeding from a very distant point, such as the sun, while not exactly parallel, yet in considering rays which enter the eye, it is sufficiently accurate to assume that those which come from a distance of more than six metres are parallel. Convergent rays are those which after passing through a refracting medium of sufficient strength, as of a convex lens, tend toward a focus behind the lens.

What is the visual axis?

The visual axis is an imaginary line drawn from the object looked at, to the macula lutea, the visual center of the retina, and cuts the cornea slightly above and to the inner side of the optical axis.

What is the optical axis?

The optical axis is the imaginary line connecting the anterior pole of the eye, which is the geometric center of the cornea, with the posterior pole, which is the center of the back part of the eye.

What is meant by amplitude of accommodation?

The amplitude or extent of accommodation is the measure of the force necessary to change the focus of the eye from its punctum remotum or remote point, to its punctum proximum or near point, and is equal to the difference between the refracting power of the eye when in a state of repose, and when its maximum amount of accommodation is in force. It is equal to the strongest convex lens with which a person can see

clearly small reading type at the distance of his near point.

What is understood by the near and remote point?

The eye is able by muscular effort to increase the strength of its refracting power, or, in other words, to accommodate itself for the vision of near objects. This is effected by an increase in curvature of the surfaces and consequent lengthening of the antero-posterior diameter of the crystalline lens. The near point is that which in the state of greatest refraction of the eye has its conjugate focus on the retina. The point for which the eye is focused when the accommodation is at rest, is called the remote, or far point.

What is the measure of the range of accommodation?

The distance between the remote and near points.

How is the range of accommodation influenced by age?

As age advances the substance of the lens becomes less elastic and the same muscular effort of the ciliary muscle does not then produce so great an increase in its convexity. Diminution in the range of accommodation, due to changes which take place in the lens, is physiological in so far as such diminution slowly and gradually takes place during life. Although not absolutely identical, there exists a very similar range of accommodation in all individuals of the same age, the range being less the older the individual, until it completely disappears, when no power remains of altering the refraction of the eye.

Do other conditions than that of age affect the range of accommodation?

Yes; it may be lost from paralysis due to the action of certain drugs or from certain diseases, such as diphtheria, or those affecting the motor nerves of the eye, or diseases of the eye-balls, or other portions of the body which may impair its function.

What is spasm of the accommodation?

A tonic spasm of the ciliary muscle which is not uncommon in hyperopes, astigmatics and myopes, and which also occurs in normal eyes. The contraction of the ciliary muscle relaxes the suspensory ligament so that the lens is constantly in a state of increased convexity; thus the eye is maintained in a condition of accommodation for a near point, and as this contraction cannot be voluntarily relaxed, the eye appears myopic.

What reflex symptoms may it occasion?

Headaches of great variety and even more remote neurotic disturbances.

Of what may it be a complication?

Of asthenopia and heterophoria.

In what class of subjects are we likely to meet with this derangement of the accommodation?

In young children as well as those in adult life who may present a nervous system of high tension, which has been overworked or unduly stimulated, and who present either normal eyes or eyes with varying degrees of error of refraction.

What are the symptoms of spasm of accommodation?

Distant objects are only seen indistinctly, and near objects, as in reading, require a closer approximation of

the object or book to the eye to obtain distinct vision. Eye fatigue, discomfort or various eye symptoms are complained of; pain, headache, or neurotic symptoms accompany particularly the close use of the eyes.

How is it diagnosed?

When patients presenting this condition are examined as regards their distant vision and it is found imperfect and is improved or made perfect by the use of weak concave test glasses, it will be noticed that while a concave or −0.50 D. or −1 D. makes the distant vision perfect they can still read only a No. 1 reading test-type at from 5 to 8 inches with the unaided eye, when a myope of a much greater degree would read it readily at a much greater distance. This should excite our suspicion, and after the use of a mydriatic and with the ophthalmoscope and other methods of examination we may find that the refraction is hyperopic, astigmatic, myopic, or even emmetropic.

What is the treatment of spasm of accommodation?

The correction of the refractive error which may be present and which when not apparent requires the use of atropin or some other mydriatic, which by producing a temporary paralysis of the ciliary muscle gives on examination the full error of refraction, and at the same time places the muscle in a state of rest. The true condition of the refraction having been determined, the corrective glasses may have to be worn constantly.

In mild cases, rest of the eyes from near work, and the use of such remedies as Physostigma, Gelsemium, Lilium tigrinum or Agaricus may be sufficient to relax

the spasm to such a degree that the refractive anomaly can be determined and corrected without paralyzing the ciliary muscle with a mydriatic, or all the symptoms arising from the spasm may be dissipated without resort to glasses for the correction of any error of refraction which may be present.

What is presbyopia?

A shortening of the range of accommodation due to the near point of distinct vision being removed from the eye, owing to the physiological changes in the lens (the hardening of its fibres), and a consequent loss of its elasticity, and also from a loss of power of the ciliary muscle.

Where is the near point of distinct vision?

As we have already learned in the examination of the accommodation and its range, the near point varies with the age of the individual. In the infant it is within an inch or two of the eye, and as age increases up to forty years of age we find it gradually moving farther from the eye until at forty-five it is perhaps twelve inches distant, at fifty-five still farther removed from the eye, and at sixty-five to seventy-five so far removed as to make small objects indistinguishable.

What are the indications of presbyopia?

When the individual after forty years of age finds difficulty in reading the ordinary newspaper print of the day unless held at arm's length from the eyes, or in addition requires a much stronger and better light than he has been accustomed to before, the indications are

that his accommodation has failed to an extent to require some artificial aid to his vision.

How is presbyopia diagnosed?

Donders gave as an arbitrary standard eight inches as the near point of distinct vision at or about forty years of age for the normal eye. A standard test-type for close vision which should be but cannot be read at this distance and is read at a greater distance, shows that the near point has receded sufficiently far to indicate presbyopia.

What influences the advent of presbyopia in addition to age?

General debility, neurasthenia and errors of refraction, as hyperopia or astigmatism.

What is the treatment of presbyopia?

The optical correction of the loss of power of the accommodation by the use of convex glasses of such strength as to give to the individual by their use an increased range of accommodation, as well as such treatment, local or general, which may be necessary to improve the tone of the eye, its muscles or his general physical condition.

Is the appearance of presbyopia or its rapid increase always due to physiological changes dependent upon advancing age?

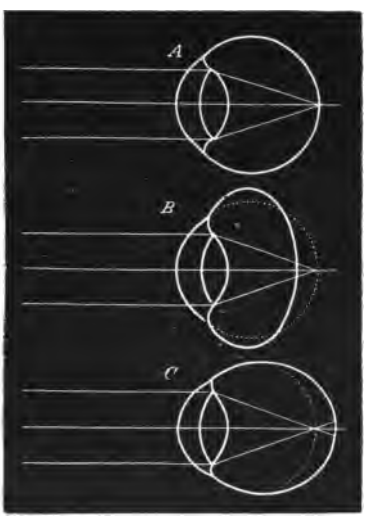
No; it is symptomatic oftentimes of a paresis affecting the motor nerves of the eye, an early symptom of glaucoma, paresis of the ciliary muscle, general debility, or to a rapid advancing senility.

What is emmetropia?

The eye is said to be emmetropic when its refractive power is such that parallel rays of light are brought to a focus upon its retina when the accommodation is in a state of complete relaxation or rest.

What power has an emmetropic eye over the divergent rays from a near object?

It possesses the faculty of increasing its refractive power by the exercise of the accommodation to such a degree as to form well-defined images upon the retina from divergent rays.



A Emmetropic eye. *B* Hypermetropic eye. *C* Myopic eye.

What is ametropia?

A condition of the refraction of the eye when parallel rays of light instead of being focused upon the retina form an image in front or behind it.

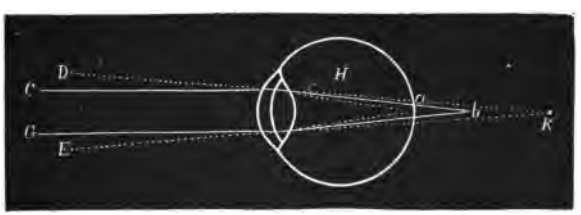
What are the two principal varieties of ametropia?

Hypermetropia, or hyperopia as it is more commonly termed, and myopia.

Hyperopia.

What is hyperopia?

A condition of refraction of the eye in which, owing to a flatness of the eye-ball, or from its length being less than the normal, parallel rays of light entering the eye are not brought to a focus upon the retina, but behind it. A blurred image of the object looked at is formed upon the retina which is in front of the focus of the refractive media of the eye.



Hypermetropia. Parallel rays, *C*, *G*, focus at *b* behind the retina; those coming from the retina emerge as diverging rays, *D*, *E*, which if prolonged backward meet at negative focus, *K*. *a*, Retina.

How may a distinct image be formed upon the retina?

If the accommodation is sufficiently powerful, the lens may become convex enough to focus the rays upon the retina and a distinct image thus be formed.

What is the cause of hyperopia?

A non-development of the eye-ball or a want of full development in its rotundity; such a congenital defect

being commonly discovered about the time the child begins to read.

Is it always congenital?

No, it may be acquired.

How is it acquired?

By operations involving a section of the cornea, as an iridectomy or cataract operation, or by loss or removal of the lens.

What is the proportion of hyperopic to normal eyes?

The proportion is differently given by various observers, but it may be stated that hyperopia presents one of the most common errors of refraction, exceeding in frequency all others.

What are the symptoms of hyperopia?

The patient may see well at a distance, but has difficulty in maintaining clear vision for near objects. Since the hyperopia can be more or less corrected by accommodation, if of low degree, no difficulty may be experienced for some time until from continued effort or other causes the accommodation becomes weakened; there is complaint of fatigue of the eyes, aching in or around the ball, headache, frontal, temporal, or occipital, or of almost any description. More remote nervous reflexes are not uncommon, and chorea and epilepsy may result from hyperopia in some cases.

How is it diagnosed?

By first determining the acuteness of vision for distance by the standard test-types, which is often found normal, but if the vision still remains unchanged when

a series of convex glasses are placed in front of the eye, the strongest convex glass so used, which does not impair the vision, is the measure of the manifest or open hyperopia. The unaided vision is then recorded $V=\frac{2}{2}\frac{0}{0}$, and if the strongest convex glass which can be used without blurring the vision is for example 1.50 D, then the record is, hyperopia manifest or Hm.=1.50 D. If the vision is not perfect, but is made so by the use of a convex lens, the strongest lens which gives the best vision is the measure of the Hm.

What is latent hyperopia?

That portion of the hyperopia which is concealed by the action of the accommodation in the effort to produce a clear image upon the retina.

How is it determined?

By paralyzing the accommodation with a proper mydriatic, and when this has been accomplished, the measure of the refraction being taken, the total amount of hyperopia is obtained, and the latent is the difference between the total or absolute hyperopia and the manifest hyperopia.

By what other means can the diagnosis of hyperopia be made?

By the ophthalmoscope in both direct and indirect methods and by the shadow-test.

How is it accomplished by the direct method?

With the ophthalmoscope held close to the eye, the disk containing the lenses is rotated until a clear image of the fundus is obtained; the strongest lens with which

this image is obtained will indicate the degree of hyperopia.

How by the indirect method?

An inverted aerial image of the disc is formed in front of the biconvex lens held before the eye. The lens should be held close to the patient's eye and gradually withdrawn, while the image is kept in view; if the image becomes larger myopia is present, for in emmetropia the size of the image remains the same, while in hyperopia it appears smaller.

How by the shadow-test?

The light being reflected into the eye by means of a concave mirror of 9 inches focus held at a distance of about four feet from the patient, the red reflex will be observed through the opening in the mirror; on slightly rotating the mirror, the illuminated area of the pupil may disappear if the eye is emmetropic, or the edge of a shadow appear on the same side as the rotation or in the opposite direction in ametropia in accordance with the refraction of the eye under observation. If the mirror be rotated to the right the shadow moves in the opposite direction or against the rotation of the mirror, when hyperopia is present. When hyperopia is thus diagnosed a series of convex lenses are placed in front of the patient's eye until one is found with which there is no longer any motion of the shadow, and this lens is the approximate measure of the hyperopia.

What affection of the muscles commonly results in hyperopia?

Convergent strabismus. The internal recti muscles

becoming over-developed from their frequent exercise in the associated action of the accommodation, which is in constant use in the hyperopic eye.

What is the treatment of hyperopia?

The wearing of glasses in front of the eyes of such convexity and strength as to cover either only the manifest, or the absolute or total amount of hyperopia. Thus placing the eye by these mechanical aids in a condition, as far as possible, approaching that of normal refraction. The glasses in the majority of cases are to be worn constantly for both near and distant vision to obtain the best results.

Myopia.

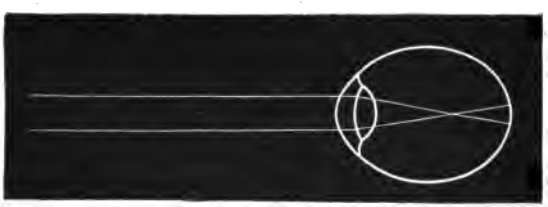
What is myopia?

That condition of the refractive media of the eye when it is too great or when the antero-posterior diameter of the eye-ball is too long; in either case parallel rays of light are brought to a focus in front of the retina, and the image formed upon the retina is an indistinct or blurred one.

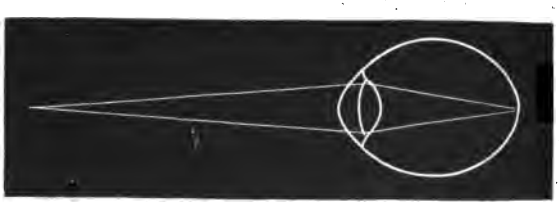
What are the causes of myopia?

The causes which give rise to myopia are yet not fully understood. While it may be congenital, the tendency to its development is often hereditary. In the latter case it is most frequently acquired between the ages of seven and fifteen, very rarely appearing after twenty-five. The more frequent causes being those which arise from prolonged use of the eyes in looking at small objects held close to the eyes, especially

when poorly illuminated. The constant use of the eyes for near work in the young, while these organs are developing, undoubtedly causes the early acquirement of myopia. Improper arrangement of the light, the desks and the position of the child student, as well as the imperfect print of text-books, excessive blackboard work or too much writing, to which children are subjected by our present educational system, tend to increase the number of myopes.



Myopia. Parallel rays focus in front of the retina, cross and form a circle of diffusion in place of a clear image.



Myopia. Only divergent rays from near objects focus on the retina

What are the symptoms of myopia?

Distant objects are not seen, or when seen are indistinct, while near objects are seen clearly. The eyes are prominent and full, the pupils are large, and in the

effort to see the individual soon acquires the habit of nipping the lids together or partially closing them for the purpose of obtaining better vision by cutting off the more divergent rays. In addition to the difficulty in seeing distant objects the patient may complain of pain in or around the eye-balls, fatigue and discomfort from dim light on close use of the eyes.

What is progressive myopia?

That condition of the myopic eye where there is a constant increase of the degree of myopia due to changes in the coats of the eye-ball, which result in its elongation.

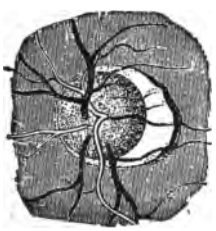
What are its dangers?

The rapid increase of the myopia, which is usually exhibited between the ages of ten to twenty or twenty-five years of age, is due to pathological changes in the coats and tissues of the eye-ball, and with such changes we have not only the increase of the myopia to that of high degree, but also, often, a great or complete loss of vision.

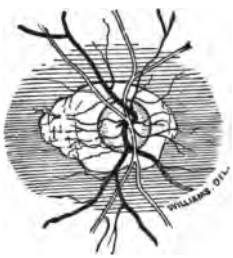
What are the pathological changes which are found in myopia?

In myopic eyes of both high and low degree there is usually presented certain changes of the retina or choroid around the disc as a result of a diseased condition of these coats, which may be considered as the accompaniment of myopia. These changes become apparent in slight degrees, but are more prominent and more grave in higher degrees and when the myopia is progressive. These changes consist in a stretching of

the sclerotic and choroid and a constant atrophy of these delicate tissues, the sclerotic coat becomes thinned and expanded, more particularly at the temporal side of its posterior portion. This extension of the sclera while giving elongation to the eye-ball, puts the choroid and retina upon a stretch so that a separation of the choroid around the optic nerve entrance occurs and the retina, being a part of the optic nerve, is liable in this stretching process to become detached from the choroid. The space formed by the separation of the



Myopia. Crescent due to posterior staphyloma.



Posterior staphyloma encircling the optic nerve.

choroid from its ring around the optic nerve entrance permits us to view the sclera, which is uncovered by the separation of the choroid, and enables us to diagnose the condition which is termed posterior staphyloma, the inference being that the portion of the sclerotic thus seen indicates the distension posteriorly of this coat of the eye-ball. In addition to this change visible by the ophthalmoscope to a greater or less degree, there is usually presented evidence of hyperemia or inflammation of the choroid, hemorrhages in the retina

and retinal detachment. The changes in the vitreous, as its liquidation or the presence of opacities, are among the not infrequent pathological changes which are presented in advanced cases of progressive myopia.

How is the diagnosis and degree of myopia determined?

By the use of concave trial lenses. If the distant vision is poor and is improved or made perfect by concave lenses placed before the eyes in the usual test for acuteness of vision, myopia is diagnosed. The number of the weakest lens which gives him perfect vision for distance is the measure or degree of his myopia.

If the vision is not made perfect by the use of any concave lens, what is to be suspected?

That in addition to the myopia there is a loss of vision due to a diseased condition of the choroid and retina, or other pathological changes, and additional refractive errors.

By what other means may the diagnosis of myopia be made?

By the ophthalmoscope and shadow test.

How is myopia diagnosed by the ophthalmoscope?

In the direct method the fundus cannot be distinctly seen until a concave glass is placed in front of the observing eye. The weakest concave glass with which the details of the interior can be clearly seen when the observer's eye is emmetropic or corrected, his accommodation relaxed, and also that of the patient, is the measure of the degree of myopia. In the indirect method the optic disc increases in size as the objective lens is withdrawn from the eye.

In the shadow-test what is observed?

The shadow moves in the same direction as the rotation of the concave mirror, when the observer is beyond the far point of the patient's distinct vision.

What are the complications of myopia?

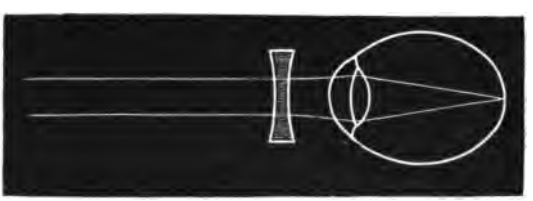
In addition to the pathological conditions already mentioned, astigmatism is oftentimes present, as well as spasm of the accommodation.

What is the effect of the exercise of the accommodation in myopia?

To lessen the distinctness of the image by bringing it still further in front of the retina.

What affection of the muscles may result from myopia?

The power of convergence becomes impaired from non-use and divergent strabismus frequently occurs.



Myopia. Concave lens rendering parallel or distant rays sufficiently divergent to focus upon the retina.

What is the treatment of myopia?

The important considerations of treatment are to prevent the increase of the myopia by the improvement of the general health, as well as the local condition, which involves a consideration of the hygiene of both the body and organ, the improvement of the vision of

the patient by the use of suitable concave glasses, and the medical and surgical treatment of those complications which may present themselves.

How is the proper glass determined for myopia?

In the examination with trial glasses, the weakest concave glass which gives the best vision for distance is ordinarily the glass which corrects the myopia. In very high degrees of myopia or where it is progressive it is usually best not to cover the full amount of the myopia with a glass. If glasses are required for music or close work a weaker lens than that used for distance is prescribed.

Astigmatism.

What is astigmatism?

That condition of the eye in which there is a difference in the refracting power of at least two of the principal meridians of the cornea or lens. The rays of light passing through the cornea and lens are not brought to a focal point upon the retina, the focus being perhaps perfect in one direction but not so in that at right angles to it; the image of the rays thus produced is oval instead of round.

What forms of astigmatism are described?

Two, the regular and irregular.

What is understood by regular astigmatism?

That condition in which rays entering the eye are refracted unequally in different meridians, the meridians of greater and lesser refraction usually being at right angles to each other.

What is irregular astigmatism?

That condition of the cornea or lens in which there is an irregularity in the refracting power of the same meridian, the condition not being correctible with lenses.

What is simple astigmatism?

That condition in which one of the principal meridians is normal or emmetropic, and the other is either hyperopic or myopic.

What is compound astigmatism?

If the eye is myopic in both meridians, but of different degrees, there is compound myopic astigmatism. If hyperopic in both meridians, it is called compound hyperopic astigmatism.

What is mixed astigmatism?

That condition in which one meridian is myopic and the other hyperopic.

What are the symptoms of astigmatism?

More or less defective vision with asthenopia, headache, and other reflex symptoms which become especially prominent on close use of the eyes.

Of what is astigmatism a frequent complication?

High degrees of myopia and hyperopia.

How is astigmatism diagnosed?

As in other errors of refraction, by the use of trial-lenses, the ophthalmoscope, the shadow test, the ophthalmometer, and other methods.

How by the use of trial glasses?

In very much the same manner as for testing hyperopia or myopia, except that cylindrical instead of spherical lenses are used, and the correction is made

in the direction of a single meridian. The glass which furnishes the correction is also the measure of the defect. In the test special test-types, as radial lines, or letters made up of black and white lines at various angles for the different letters, are used in addition to the ordinary test-types. In some cases the use of a mydriatic is necessary before the full defect can be measured.

How is astigmatism discovered by the ophthalmoscope?

If astigmatism is present the ophthalmoscopic image of the optic nerve is elongated or oval. In the direct method the elongation corresponds to the meridian of greatest curvature, which is usually vertical, or nearly so. In the indirect method the disc also appears elongated, but owing to the inversion of the image, in the opposite direction to that of the affected meridian. The blood-vessels radiating from the disc also come under examination, and the distinctness of the vessels in one direction and their indistinctness in another give us a clue in these methods to the meridian affected.

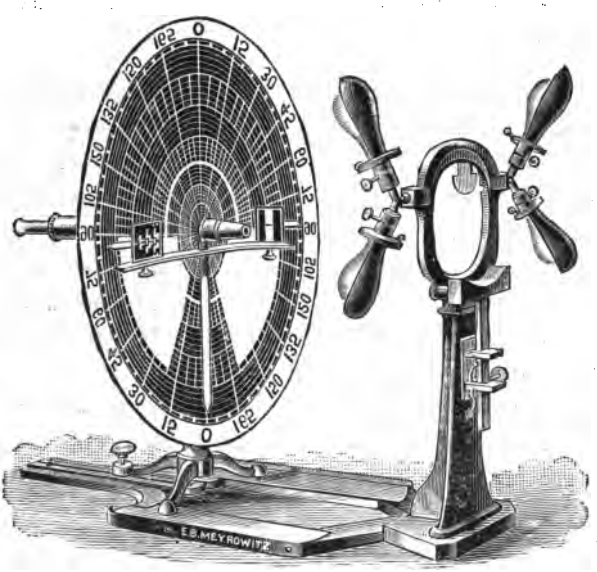
How is astigmatism detected by the shadow test?

The fundus illumination appears oval. The refraction of any one meridian is obtained by noting the movement of the shadow in that meridian, each of the principal meridians being tested separately. The eye when presenting compound astigmatism has its myopia or hyperopia first determined by the shadow test for those errors, and then examined as to its defective meridian.

What does the ophthalmometer accomplish?

When properly used this instrument enables the observer to measure with fair accuracy the curvature of the refracting surface of the cornea, and determine the amount of regular astigmatism which is present.

The most accurate instrument for the purpose is



Javal-Schiotz ophthalmometer.

that of Javal and Schiötz, which consists essentially of a pair of porcelain plates called mires, which are movable along an arc of a circle so graduated that the distance between the plates can be easily read. These plates when properly illuminated are the objects which are reflected from the cornea of the observed eye, and

this image is examined through a telescopic tube containing, in addition to the proper lenses, a double prism of calcspar which doubles the images of the plates, the two middle images being the ones whose behavior alone is considered. The semicircular arm which carries these plates is so made as to be freely rotated around the axis of the examination tube, so that when the latter is directed upon the eye, the arm may be made to take a position corresponding to that of any meridian of the eye which it is desired to examine. The chin of the patient is placed upon the rest provided for the purpose, the eye not under examination being covered by a shade, the eye-piece is directed upon the cornea and approached to it until on looking through the tube a good image of the plates or mires is seen. The semicircular arm is now turned in the direction in which there is the greatest separation of the two central images; this is the meridian of least curvature. Now the plates are brought together so that their central images just touch, the arm is now made to make a sweep of 90°, and if there is astigmatism the edges of the images overlap. One of the plates or mires is so notched as to make the overlapping of the images by the width of each notch indicate a degree of astigmatism in dioptres; the overlapping of two or three notches or steps indicating two or three dioptres of astigmatism.

What effect has astigmatism in the production of fatigue of the eye, eye headaches, or more remote reflex neuroses and nervous phenomena?

It is a marked factor in the production of asthenopia

and heterophoria, and it furnishes one of the most common causes in the production of such nervous symptoms.

What is the treatment of astigmatism?

The treatment of astigmatism consists in the correction of the optical defect as far as possible by placing in front of the eye, lenses properly ground and so adjusted as to relieve the eye of the visual effort, which is the accompaniment of its defect, and also give all the improvement of vision which may come from the proper use of such lenses.

What is anisometropia?

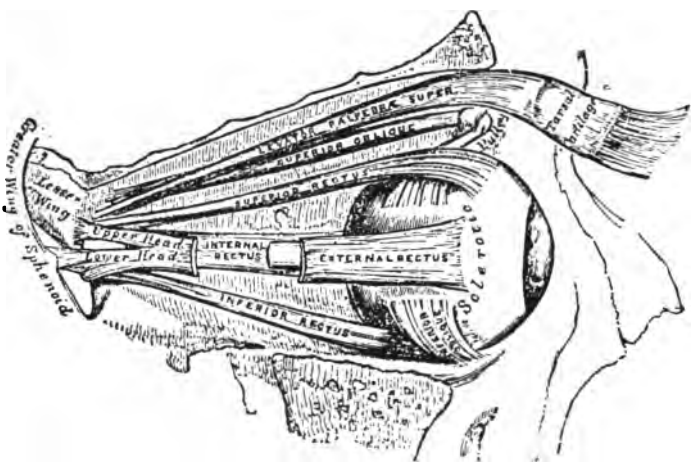
When the refracting power of the two eyes is not alike, as when one eye is hyperopic and the other normal or myopic, the condition is termed anisometropia.

The Muscles of the Eye.

The examination of the eye is never complete, particularly when neurotic symptoms which might be occasioned by this organ are present, even when all the methods of examination already detailed have been used in the effort to determine the presence in the eye of a possible cause of the reflex, until the condition of the muscles both as to their power and function has been determined. The investigations in the last few years as well as the results following the proper correction of defects which are frequently found in the action of the extrinsic muscles of the eye-ball have taught us that their defective function is of paramount importance in its bearing upon obscure or remote nervous phenomena.

What are the muscles of the eye?

First, the external or extrinsic muscles which control the movements of the eye-ball; second, the internal or intrinsic muscles, those of the iris and ciliary body, which regulate the amount of light admitted into the eye, as in case of the iris, and increase the refrac-



External muscles of the eye-ball.

tive power of the eye, as in the case of the ciliary muscles during the act of accommodation.

What are the extrinsic muscles of the eye?

The four recti and the two oblique.

What is the function of the extrinsic muscles?

To move the eye-ball in such directions that the image of the object looked at will be formed upon the retina at its most sensitive portion, the fovea centralis.

What is necessary on the part of these muscles to obtain distinct single vision?

That the action of the muscles of the two eyes is such as to direct the visual axes of the eyes to the same point, so that the images formed in the two eyes fall upon symmetrical portions of the retinas.

What is binocular vision?

When both eyes have their visual axes directed upon an object, each eye receives an image upon the most sensitive portion of the retina; these impressions when transferred to the optical areas on each side of the brain are so combined as to form a composite image which differs slightly from either of the two images formed on the retina, and from which arises the idea of a single object.

What is the value of binocular vision?

It enables us to appreciate the solidity of objects without applying the sense of touch.

What is meant by the associated movements of the eyes?

That the muscles of one eye act in harmony with those of the other so as to make the visual lines parallel, or direct them to the same point.

What is understood by the accommodative movement of the eyes?

That action of the internal recti muscles of the eyes by which there is a convergence of the visual lines, the muscle of accommodation and that of the iris participating.

When all the external muscles of the eye are in a state of rest, what is the position of the visual lines?

They are either parallel or slightly divergent.

When the eye-ball is turned upward, what muscles are required for the movement?

The superior rectus and inferior oblique.

In the downward movement what muscles are necessary?

The inferior rectus and superior oblique. .

In the inward movement?

The internal rectus.

In the outward movement?

The external rectus.

In the upward and inward movement?

The superior and internal recti and inferior oblique.

In the upward and outward movement?

The superior and external recti and inferior oblique.

In the downward and inward movement?

The inferior and internal recti and superior oblique.

In the downward and outward movement?

The inferior and external recti and superior oblique.

If there is a loss of the functional power of any of the muscles of the two eyes, what occurs?

Diplopia or double vision.

What is diplopia?

A condition of vision occurring when both visual lines are not fixed upon the object; the images are then formed upon different parts of the two retinas, and two objects are seen instead of a single one.

What is the cause of diplopia or double vision?

A paresis or paralysis of one or more of the muscles which move the eye-ball.

In addition to the double vision, what other symptoms are presented as a result of paralysis of the ocular muscles?

The direction of the two eyes does not correspond and strabismus or squint is more or less apparent. There is loss or limitation of the movement of the eye-ball in the direction of the affected muscles. Inability to accurately determine the position and distance of the object looked at. Vertigo, dizziness and confusion of vision when both eyes are open, and an unnatural position of the head, resulting from the natural impulse of the patient to carry the head in that direction in which he is least troubled by the double vision.

What is meant by the primary deviation?

The loss or limitation of the movement of the eye ball in the direction of the affected muscle.

What is understood by the secondary deviation?

When the affected eye attempts to fix upon an object, the nervous impulse required for the effort is greater than when normal, but the same degree of impulse is sent to both eyes so that the unaffected eye has an excess of energy sent to it, and the action of the muscle of the healthy eye corresponding to that of the affected muscle of the other is as a result greater than that of the latter and the movement of the healthy eye in direction is greater than that of the other and is called the secondary deviation.

What are the two varieties of diplopia?

Homonymous or simple and heteronymous or crossed; so named according to the relation which the double images bear to the eyes.

What is homonymous diplopia?

That condition in which the image on the right is that of the right eye, the visual lines are crossed, but the images are not.

What is heteronymous diplopia?

When the image on the right is that of the left eye, the images being crossed, but the visual lines not.

What is the method of determining the muscles affected when diplopia occurs?

A lighted candle or other source of illumination is placed on a level with the eyes of the patient at a distance of twenty feet in a dark room. One eye of the patient is covered by a red-colored glass. If the patient has diplopia he will see two lights, one red and the other white. If the red glass is in front of the right eye and the red light is on the right there is homonymous diplopia due to paresis or paralysis of the external rectus. If, however, the red light appears on the left, then there is heteronymous diplopia from loss of power of the internal rectus. A careful study of the double images produced in diplopia, as regards their degree of separation, their difference in height and inclination to or from each other, forms the basis for diagnosis of muscle or muscles affected.

What are the positions of the images in paralysis of the internal rectus?

The images are crossed, and in looking directly forward are parallel and of the same height. With the heteronymous diplopia the motions of the eye in other

directions cause some variation in the distance between the images as well as in their height and inclination.

In paralysis of the external rectus, what is the position of the images?

There is homonymous diplopia; the images are not crossed, are parallel and on the same level, when the patient looks directly forward. When he looks in other directions, there is some change in the separation, height, and inclination of the images.

What effect does paralysis of the superior or inferior rectus have upon the images?

In both cases there is heteronymous diplopia. When the superior is affected, the image of the affected eye is raised above that of the other eye and tilts toward it at the top on looking up; on looking down the images come together and the diplopia disappears. When the inferior is at fault there is no diplopia on looking up, but on looking down the images separate; the image of the affected eye is below and tilts toward that of the other eye.

In paralysis of the superior or inferior oblique, what is the position of the images?

There is homonymous diplopia in both. In case of the superior oblique, on looking downward there is a separation of the images, which are homonymous and vertical. On looking upward there is no double vision. When the inferior oblique is affected, there is diplopia on looking upward, and the images are homonymous and vertical.

What is ophthalmoplegia?

A term applied to paralysis of all the external muscles of the eye with or without implication of the internal muscles.

What are the causes of paralysis of the ocular muscles?

The active causes are found in rheumatism, syphilis, inflammation of nerve sheaths, localized periostitis, injuries, colds, basilar meningitis, tumors of the orbit or cranium, hemorrhages within the brain or along the course of the motor nerves of the eye, and certain brain lesions.

What is the treatment of the various ocular paralyses?

The treatment varies according to the cause, and consists of such local treatment as the use of galvanism, and the exercise of the affected muscle by means of prisms. The diplopia may require the wearing of prisms for its relief, when slight, and the squint which remains when all chance of recovery of the paralyzed muscle is gone may require an operation for its relief. Internal medication proves curative in many cases when the prescription is based upon the proper indications for the remedy.

What are the indications for the more useful remedies in paralysis of the ocular muscles?

Aconite.—Suits the cases of partial paralysis arising from exposure to cold winds or draughts.

Argentum nitricum.—Paralysis of the internal rectus has been relieved by this remedy.

Arnica.—In paralysis resulting from injury.

Causticum.—Paralysis particularly of the external rectus, resulting from exposure to cold, with some involvement of the third nerve, and may be useful in a general peripheral paralysis of any of the ocular muscles.

Chelidonium.—Paralysis of the right external rectus.

Cuprum aceticum.—Paresis or paralysis of the external rectus.

Euphrasia.—Paralysis of the branches of the third nerve arising from exposure to cold or wet, the ocular symptoms of Euphrasia being present.

Gelsemium.—Very valuable in those cases following diphtheria, the paresis of the external rectus being more marked.

Kali iodidum.—Particularly indicated in paralysis of the muscles arising from syphilitic causes, more commonly the paralysis of the rectus externus.

Mercurius iodidum.—Paralysis of the third nerve and its branches in cases arising from syphilis.

Nux vomica.—Paralysis or paresis of the ocular muscles, accompanying gastric disturbances, and when caused by tobacco or stimulants.

Phosphorus.—Paralysis of the muscles arising from sexual excesses, and accompanied by general loss of muscular tone.

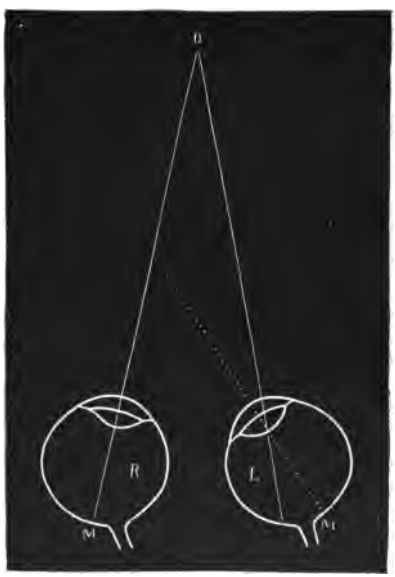
Rhus toxicodendron.—Paralysis of the muscles arising from rheumatism, exposure to cold and wet.

Spigelia.—When the muscle condition is associated with sharp, stabbing pain through the eye and head.

Other remedies, as Aurum, Conium, Hyoscyamus, Morphia and Sulphur, may be used with advantage.

What is strabismus or concomitant squint?

A condition of the muscles of the eye in which there is an inability to bring the visual axes of both eyes together upon an object, one visual axis always



Convergent concomitant strabismus.
R **Right eye directed to object** ***O.*** ***L*** **Left eye deviating inwards.** ***M*** **Macula.**

deviating from the other in all directions in which the eyes are turned. There is no diplopia, as the individual learns to disregard the image of the squinting eye; the primary and secondary deviations are equal, and the eye-ball moves freely in all directions.

How does it differ from paralytic squint?

The latter is caused by the paralysis of one or more muscles, presents diplopia, a loss of movement of the eye in the direction of the paralyzed muscle, and the secondary deviation is greater than the primary.

What are the varieties of concomitant squint?

Convergent or internal, divergent or external, sursumvergent or upward, deorsumvergent or downward; the two former being the important ones.

When is squint intermittent or periodic?

When the deviation of the eyes is not constant, the squint occurring only at intervals.

When is squint alternating?

When the vision is nearly equal in the two eyes, but the refraction unequal; one eye or the other will deviate, according to which eye is used for fixation.

Describe convergent strabismus.

Convergent strabismus depends on a shortening of the internal rectus muscle and generally commences in infancy. The visual axes cross in front of the object, and there is diplopia in the beginning, but the child soon learns to suppress one image, and from this suppression of the image the squinting eye soon becomes amblyopic from non-use.

What causes convergent squint?

The causes of convergent strabismus are various: convulsions, pertussis, measles, scarlatina, fright, falls and imitation of other squinting children, opacities of cornea and refractive anomalies. The most common cause, however, is hypermetropia due to the fact that,

when we look at near objects, we do two things: we converge the optic axes by using the internal recti, and accommodate for a near point, convergence and accommodation being physiologically connected. In hypermetropia, the accommodation is constantly brought into use for objects at all distances, and increased convergence or a tendency to overconvergence results.

How is convergent squint diagnosed?

The diagnosis ordinarily is easily made; the squinting eye deviates inward while the other is fixed upon an object held before the patient.

What is the treatment of convergent squint?

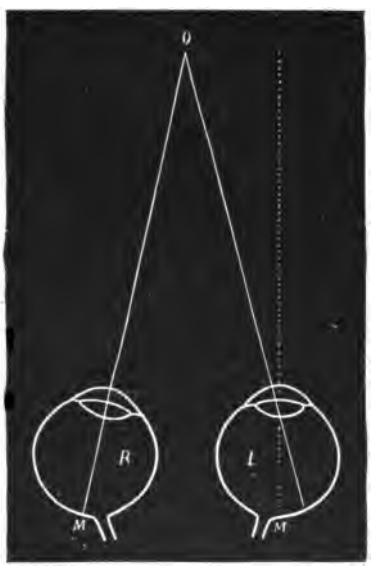
Correction of any error of the refraction present with the proper glasses may cause a disappearance of the squint. If the patient applies for treatment before the squint becomes fixed, the use of atropin to paralyze the accommodation of both eyes, by preventing near vision, lessens the tendency to convergence and may effect a cure. Bandaging the sound eye for stated periods daily will retain and increase the visual power of the affected eye in some cases. When the squint is recent such remedies as Cicuta, Jaborandi, Belladonna, Gelsemium, and others often effect cures. When the squint has become fixed and the patient is eight years of age or over, tenotomy of the internal rectus of the squinting eye should be performed.

What is divergent strabismus?

Divergent strabismus exists when one eye fixes the object looked at and the other deviates outward.

What are the causes of divergent strabismus?

It is usually dependent on myopia, a state of refraction in which convergence has to be used in excess of the accommodation if a well-defined image is to be formed on the macula of each eye; but divergent strabismus may occur in any case in which binocular



Divergent concomitant strabismus.
R **Right eye directed to object** ***O.*** ***L*** **Left eye deviating outwards.** ***M*** **Macula.**

vision does not exist, as in some cases of hypermetropia or astigmatism; or it may result from a too free division of the internal rectus muscle, in attempting to correct convergent strabismus.

How is divergent strabismus diagnosed?

Divergent strabismus is readily diagnosed from the

fact that when one eye is fixed upon an object the other deviates outward.

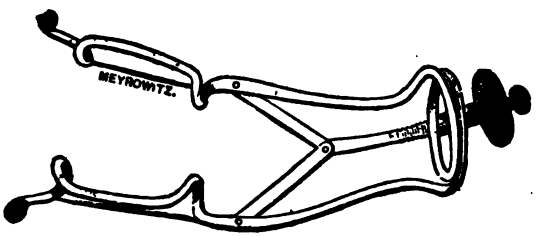
What is the treatment?

When dependent upon refractive error proper glasses are to be prescribed and worn. If the condition is not soon relieved, the full correction of the myopia should be made unless the condition of the eye is such as to forbid it. Usually tenotomy of the external rectus is necessary.

How is the operation of tenotomy for the correction of strabismus made?

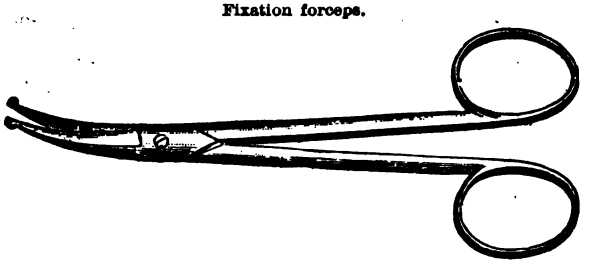
The instruments necessary for the operation for the correction of strabismus are a speculum, a pair of fixation forceps, a pair of curved scissors and two strabismus hooks. Three or four instillations into the eye at intervals of ten minutes of a 4 per cent. solution of cocaine hydrochlorate will render the operation comparatively free from pain. Introduce the speculum to hold the lids apart, and with the fixation forceps grasp the conjunctival and subconjunctival tissues over the insertion of the muscle, cut through them with the scissors in a vertical direction, dissecting the tissue more or less as is deemed necessary, introduce the hook under the tendon, which is then raised upon the hook and carefully divided with the scissors close to the sclerotic. The hook is again introduced to ascertain whether all the fibres of the tendon have been divided, care being taken not to produce too much separation of Tenon's capsule by sweeping the hook too far around. Hemorrhage is sometimes profuse, but is easily controlled by cold com-

presses. The patient is now directed to look at the finger, held a foot distant before the eye, and the position of the eyes noted. If the extent of the operation



Eye speculum (Noyes).

Fixation forceps.



Curved scissors, probe pointed.

Strabismus hook.

has been well gauged the eyes will fix properly upon the object. When the operation is made subconjunctively the tissues are incised along the border of the muscle

only to such an extent as may enable the introduction of the hook and the division of the tendon beneath the conjunctiva.

How is the operation for advancement of the muscle in strabismus made?

This operation is performed to increase the effect of simple tenotomy, the opponent of the tenotomized muscle being the muscle advanced. The conjunctiva next to the cornea is incised and dissected up and sutures are passed. These are three in number, a central, one above, and one below, each passing through the margins of the muscle, the conjunctiva and Tenon's capsule, beginning at about one-third of an inch from the insertion of the tendon. The sutures are then tied, after first having removed a small piece of the tendon. The middle suture is first tied and tightened and then the lateral sutures until the desired effect is obtained.

What is nystagmus?

Nystagmus is the name given to involuntary oscillatory movements of the eye, which are mostly from side to side, yet may be rotary or almost vertical. They are generally constant, but increase in intensity with attempts at fixation or when the individual is excited.

What are its causes?

It manifests itself in infancy and is generally associated with anomalies of refraction, together with opacities of the cornea of lens and lesions of the cerebrum, choroid, retina or optic nerve.

What is its treatment?

In some cases with the absence of objective lesions, a cure has followed the use of Agaricus, Hyoscyamus, Belladonna, or Stramonium. In other cases, in older children, the use of glasses, particularly for the correction of hypermetropia and astigmatism, has given good results. In the acquired form it is frequently presented in coal miners, the condition arising from the narrowness of the drift in which they are working, which requires the prolonged use of the eyes in an upward direction. The nystagmus frequently disappears on return to the outside world and from prolonged rest.

What is muscular asthenopia?

Muscular asthenopia is a condition of weak or painful vision due to insufficiency of some of the external muscles of the eye and is the common accompaniment of errors of refraction; the internal recti suffering in myopia and the external recti in hyperopia.

What is accommodative asthenopia?

A condition frequently associated with muscular asthenopia and due to weakness of the ciliary muscle, in which the close use of the eyes becomes painful or impossible.

How is muscular asthenopia determined?

To determine muscular asthenopia the patient is directed to look at a pencil held eight or ten inches from the eye in the median line. One eye is then covered by a card in such a manner as to shut out the eye from the object of fixation, but at the same time to enable the observer to see if it deviates outward. A

more delicate test is that of von Graefe, in which a prism of eight or ten degrees is placed base up or down before one eye, and the patient directed to look at a black dot on a line held at the usual reading distance. If the relative strength of the muscles is normal, two dots will be seen on the same line, but if two lines appear with a dot upon each, the lateral separation of the lines determines an insufficiency which may be accurately measured by prisms base in or out, as the case demands, using such a degree as will cause a fusion of the images of the lines; a colored glass placed before one eye will determine whether the images thus formed

Test for muscular insufficiency.

are homonymous as in affections of the external recti, or heteronymous as with insufficiency of the internal recti.

What terms are used to more accurately describe the varieties of muscular insufficiency?

Orthophoria, the visual lines tend to parallelism, the normal condition of the muscles. Heterophoria, the visual lines tending in some other way, indicating an abnormal condition. Esophoria, the deviation being inward; exophoria, the deviation outward; hyperphoria, when the deviation is upward.

What is used to determine whether heterophoria is present?

The Stevens phorometer, the Maddox test, the Savage test and that of others; the strength of each

muscle being measured by the use of prisms. To determine heterophoria by Stevens phorometer the patient is directed to look at a lighted candle 20 feet distant, which should be on a level with the eyes. Then after correcting any refractive error which may be present, a prism of sufficient power to produce diplopia is placed before one eye and a red glass before the other eye. Two images will be seen, a red and a white, one above the other. For example: if the red glass is placed before the right eye and the prism, base down, before the left eye, in esophoria, the image of the right will be lower than that of the left eye and to the right, to a degree to be determined by another prism placed base in before the eye. In exophoria there will be heteronymous or crossed diplopia, the amount of which can be measured in the same manner as in esophoria, but with the base of the prism out. Hyperphoria is recognized by the fact that the image of one eye is above that of the other, and becomes right or left hyperphoria according to the eye affected.

What is the Maddox test?

The Maddox test is made by using a small glass rod which is mounted so as to be used in a trial frame and placed before one eye, the rod being vertical, with a red glass in front of the other; when looking at a lighted candle, a long horizontal line of light is seen by the eye in front of which the rod is placed, while the other eye sees the red light. If the line of light passes through the center of the red flame seen by the other eye, there is no hyperphoria present; but if it is above or

below, then hyperphoria is present, and the degree determined by the prism which causes the line to pass directly through the center of the flame. We now turn the rod horizontally and a vertical streak of light will be shown, which, if it passes through the center of the red light, orthophoria of the lateral muscles will be shown. If, however, the line of light is to the same side as the eye before which the rod is placed, it indicates esophoria; and, if to the opposite side, exophoria, and the prism required to bring the line of light directly through the flame will determine the amount of esophoria or exophoria present. This test is considered one of the most delicate and accurate.

What is the treatment of muscular asthenopia?

The treatment of muscular asthenopia requires the fitting of proper glasses, the exercise of the weak muscle by the use of prisms; the improvement of the general nutrition and nerve tone of the patient by the use of tonics, both local and general, and the use of electricity in conjunction with such homeopathic remedies as may be indicated.

What remedies are of value for the relief of asthenopic symptoms?

Aconite.—Asthenopia from over use of the eyes; the lids tend to close and have a sensation of weight in them. Hot and dry feeling of the eyes after use, with relief from cold applications.

Agaricus.—Twitching of the lids, or a sensation of twitching in the eye-balls.

Argentum nitricum.—Weakness of the internal recti, together with weakness of the accommodation

dependent upon hyperopia; blurring and dancing of the letters.

Duboisia.—External recti weak, with weakness of the accommodation and hot, dry feeling of eyes from reading.

Calcarea carbonica.—Pains after using the eyes usually referred to the lids; sticking pains while using the eyes for close work; eyes feel better from application of hot water.

Gelsemium.—Asthenopia from weakness of the external recti, and when associated with spasmodic conditions of the internal recti.

Jaborandi.—Asthenopia, with symptoms which are really dependent upon irritability of the ciliary muscle, and in those cases of muscular asthenopia arising from reflex irritation of the uterus.

Kalmia latifolia.—The muscles, either the internal or external recti, feel stiff, with a sensation of stiffness around the eyes and in the eyelids.

Lilium tigrinum.—Burning, smarting, and heat in the eyes; relief in the open air.

Mercurialis peren.—Dryness of the eyes and heaviness of the lids; mist before the eyes; burning pain in the eyes upon reading.

Natrum muriaticum. — Frequently indicated in asthenopia, a refractive error may or may not be present. It particularly suits those cases caused by over-use, or too close application for near objects; the vision blurs and the letters run together upon using the eyes for reading. Weakness of the internal recti is oftentimes very marked; the muscles feel stiff and

drawn and ache on moving the eyes in any direction; pain in the eyes on looking down; indicated in cases of asthenopia with headache, burning, smarting, itching and heat, with a variety of other sensations.

Phosphorus.—Deficiency of sight, with pain and sensation of stiffness in the eye-ball; light aggravates, so that the patient is better in the twilight with frequently symptoms of retinal irritation.

Physostigma.—Weakness of the internal recti; fatigue and twitching of the lids upon reading.

Rhododendron.—Insufficiency of the internal recti muscles with darting pains through eyes and head, usually worse before a storm.

Sepia.—In some cases of muscular insufficiency arising from reflex irritation of the uterus; smarting of the eyes; aggravation of the symptoms in the morning and evening.

Spigelia.—If the asthenopia is accompanied by sharp sticking pains in the eye and around it, and extending back into the head.

In addition to these, many other remedies may be indicated by their constitutional symptoms, as Crocus, Cimicifuga, Ignatia, Ledum, Lithium carbonicum, Macrotin, Nux vomica, Phosphoric acid, Pulsatilla, Santonine and Sulphur.

Wounds and Injuries of the Eye.

The proper management of traumatic injuries of the eye is of the utmost importance, as the resulting condition of the eye depends very much upon the

treatment to which it is subjected immediately after the injury. The full extent of the injury should be ascertained, and if necessary general anesthesia is employed to obtain a complete inspection of the eye. When practicable, the vision should be tested and noted, as the examination of the eye after injury has frequently a legal as well as a surgical aspect. Having determined the parts injured and the extent of the lesion, and decided upon the treatment necessary, give the eye perfect rest, and refrain from too frequent examination which may retard the process of repair.

What injuries of the orbit are frequently encountered?

Punctured and gun-shot wounds, and those produced by blows directed upon the margin of the orbit, which may result in fracture of the orbital walls or injury to the contents of the orbit.

What is to be looked for in wounds of the orbit?

Rupture of the globe, or other injuries to the eyeball, fracture of one or more of the orbital walls, and the presence of foreign bodies, as bullets, shot, etc., within the orbit, and the extent of injury to the contents of the orbit.

What indicates a rupture of the blood-vessels of the orbit?

The presence of effused blood beneath the conjunctiva of the bulb and exophthalmos, the amount of protrusion of the eyeball indicating the extent of the pressure occasioned by the ruptured blood-vessels.

What is the necessity of ophthalmoscopic examination?

To determine any resulting changes or injury to the tissues within the eyeball and the cause of any

loss of sight from injury to these tissues or to the optic nerve.

What are the indications for treatment?

Thorough search for and removal of any foreign bodies, fragments of bone, etc., thorough cleansing of the wound by use of antiseptic lotions; rest, cold applications and compresses, and the use of arnica locally and internally. Any resulting discharge must be given free drainage. If orbital cellulitis supervene and abscess form deep in the orbit, an incision to allow free discharge is imperative. Ensuing cerebral complications may require enucleation of the eyeball.

Upon what will the prognosis depend?

Upon the extent of injury to the internal and external structures of the eyeball, the optic nerve, brain, or of the surrounding parts.

Mention some of the ordinary injuries of the lids.

Ecchymosis of the lids or "black eye" from contusion, incised, lacerated and contused wounds, and burns from heat or caustics.

What may occur as a result of wounds of the eyelids?

Ptosis, from division of the levator palpebræ muscle, or, if in the supra-orbital region, loss of sight as well.

How should injuries of the lid be treated?

According to general surgical rules. In simple ecchymosis, cold compresses of arnica lotion and the internal administration of Hamamelis. In emphysema, the application of a compress bandage is all that is necessary. Recent wounds are to be united with sutures.

In lacerated or contused wounds with destruction of tissue, antiseptic dressings are used. In burns, the application of lint wet with a solution of lime-water and linseed oil, or of a thick paste of bicarbonate of soda, of carbolated vaseline, or of dressings of alcohol is of value. A lotion of cantharis will occasionally lessen the tendency to suppuration.

What are the injuries of the lachrymal apparatus?

Foreign bodies, as eyelashes, hairs, bits of straw, etc. sometimes find their way into the puncta or lachrymal, conduits, or these ducts may have been divided or lacerated by wounds.

What is to be done in such cases?

When the cause of the irritation is not found elsewhere, look for foreign matter in the puncta or lachrymal conduits, and if found remove it. In a division of the ducts from traumatism, as the repair cannot be expected to restore the integrity of the parts, future operations to establish drainage may be required.

What is to be said of injuries of the conjunctiva?

That they are numerous and usually greater in extent than those of the eyeball.

What of foreign bodies?

Unless they become imbedded in the tissue they are usually washed off by the profuse secretion of tears set up by their irritation. When imbedded in the tissue, they are readily removed upon eversion of the lid, when any inflammation of the conjunctiva due to their presence rapidly subsides. Gunpowder grains may

require excision of minute portions of the conjunctiva in their removal.

What is to be done for lacerations of the conjunctiva?

Little if any treatment is indicated beyond that of the use of cold compresses and enforced quiet of the eye by bandaging after antiseptic cleansing, as they heal very rapidly.

What consideration and treatment of burns is necessary?

Burns of the eyes from lime, mortar, molten metals, ammonia, and mineral acids or other caustic substances are very common. Immediate instillation of such oily substances as cream, vaseline, sweet oil, etc., becomes necessary. The action of strong chemicals should be neutralized by appropriate solutions when the case is seen at the time of the accident. All particles of lime or mortar must be carefully picked from the conjunctival fold by forceps or a spud, and, if necessary, syringing to remove the small particles. Cocain or general anesthesia may be necessary for thorough work. After all foreign substances have been removed instil castor oil or vaseline between the lids and keep the eye at rest by a light bandage, and apply cold compresses to restrain the subsequent inflammation. Burns from the mineral acids, lime and concentrated lye, usually form eschars with subsequent contraction of the conjunctiva at the seat of injury.

What is the danger in burns of the conjunctiva?

Adhesion of the granulating surface after the eschar has been discharged, with union of the lids and eye-

ball. The effort is to be made to confine the adhesions within the smallest possible extent.

Does impairment of vision follow?

Not usually, unless the cornea be involved or the adhesions are sufficient to impede the free movement of the eyeball.

From what do we get injuries of the cornea?

Foreign bodies, particles of iron, cinders, seed husks, etc., which may become imbedded in the cornea, and present only slight, if any, irritation for several days; abrasions or erosions of the surface from scratches, contusions from direct blows, or lacerated and incised wounds from explosions, direct cuts or thrusts from various objects.

How are foreign bodies to be removed from the cornea?

If much irritation or pain occurs, the instillation of a few drops of a 4 per cent. solution of cocain hydrochlorate will produce sufficient anesthesia. Seating the patient before a good light, the head is rested upon the chest of the surgeon, who stands behind. The operator fixes the eyeball with the thumb and fore-finger of the left hand by making slight pressure upon the lids over the margin of the orbit. With a sharp gouge or spud in the other hand, the foreign body can be raised and removed without difficulty, unless it extends into the deeper layers of the cornea or projects into the anterior chamber, when it becomes necessary to hold the eyeball with a pair of fixation forceps and enter a narrow cataract knife through the cornea into the anterior chamber and behind the foreign

body, then by cutting outward remove it with the aid of a pair of forceps

What is the after-treatment?

Ordinarily the instillation of a solution of boracic acid at intervals for a few hours is sufficient; in more severe cases, the use of atropin to dilate the pupil and the application of a bandage is necessary. When, from foreign bodies which have impinged upon the cornea, the irritation of the nerve filaments causes much pain, the use of cocain solution followed by a lotion of tincture of aconite and water will ameliorate the pain and hasten repair.

What should be done if suppuration has commenced about the point of entrance of the foreign body?

Instillation in the eye of atropin solution two or three times a day will generally relieve the pain, while boracic acid solution to prevent sepsis, together with the internal use of Aconite, Hepar sulphur, Silicea or Mercurius, as indicated, will usually control the suppuration and hasten the reparative process.

How may the vision be injured?

By the scars that are left lessening the transparency of the cornea.

What is to be done for abrasion or erosion of the cornea?

Ordinarily cleansing the conjunctival sac with boracic acid solution, then bandaging the eye and enjoining rest of the eyes for forty-eight hours until the epithelial layer has again been produced. When ocurring in nursing women, or where there is a low condi-

tion of the system, suppuration of the cornea and destruction of vision may result.

What is the treatment of contusion of the cornea?

Cold applications and the use of boracic acid solutions, followed by an arnica lotion, are among the first indications, but if suppuration becomes established, thin compresses wet in a hot infusion of calendula flowers applied during half an hour several times a day, with the internal administration of Hepar sulphur or Silicea, will assist the restoration. Pus in the anterior chamber may necessitate paracentesis for its removal, if its absorption is not prompt.

How are incised wounds of the cornea to be treated?

When there is no prolapse of the iris into the wound, the eyelids should be closed after cleansing the conjunctiva with boracic acid lotion and the instillation of a drop of atropin, a bandage applied and the patient confined to bed to insure absolute rest until union takes place, which usually occurs in a few days. If there is prolapse of the iris and loss of the aqueous humor from extensive wounds, it is not advisable to return the iris by manipulation to the anterior chamber, as the pressing of these delicate parts results in iritis, which further complicates the case; but the projecting portion may be cut off with the curved iris scissors and the eye treated as when there is no prolapse.

Why are wounds of the sclerotic more dangerous to the integrity of the eye than those of the cornea?

Because of the unyielding nature of its fibrous tissue, which, with the prolapse of the vitreous, pre-

vents the edges of the wound coming into close apposition; hence such wounds heal with difficulty.

From what may rupture of the sclerotic result?

Direct compression of the eyeball, as from a blow with the fist, a blunt instrument, or a fall.

What complications may occur?

Severe injuries to the other structures of the eyeball; the lens frequently being driven out through the opening, the vitreous may follow and the eye collapse. Detachment of the choroid or retina may occur from rupture of the blood-vessels of the choroid. Sympathetic irido-choroiditis in the other eye may be caused by the prolapse of the ciliary body, choroid and retina into the wound during the healing process, necessitating removal of the injured eyeball.

What is the prognosis?

Always guarded, as the injury is such as to destroy the vision, and may be such as to prevent the eyeball being retained.

How is the tension affected in rupture of the sclerotic?

Always lessened, the eyeball feeling soft under palpation with the fingers.

What are the injuries of the iris?

They are usually the accompaniment of some other injury, and may occur as detachment of the iris after contusion of the eyeball, laceration from perforation of the cornea by sharp instruments, or the introduction of foreign bodies into the eyeball which may perforate the iris or lodge upon it. With all injuries of the iris

there is usually hemorrhage into the anterior chamber. Prolapse of the iris may complicate wounds of the cornea.

What is the treatment of injuries of the iris?

Owing to the hemorrhage in the anterior chamber, the extent of the injury is difficult to determine in cases of laceration of the iris, but the use of atropin solution to dilate the pupil is usually indicated, together with the use of cold compresses and rest of the eyes; the effect of treatment being directed in all cases toward the prevention and control of the traumatic iritis which may result from the injury. When detachment of the iris has occurred reattachment is not to be expected. When a foreign body lodges upon the iris it may be deemed advisable to remove it, and for that purpose an opening through the cornea with an iridectomy or cataract knife is made, the iris forceps introduced and the portion of the iris containing the foreign body seized, brought out and excised, a drop or two of atropin solution instilled, the eye bandaged and the effort made to prevent subsequent inflammation. If inflammation occurs the iris must be kept dilated by the use of atropin until all symptoms of inflammation have disappeared.

What use is made of the magnet?

To attract pieces of steel or iron which have become lodged in the cornea, anterior chamber, or upon the surface of the iris, and also for the purpose of removing such foreign bodies from the interior of the eye.

What are some of the injuries of the lens?

Dislocation of the lens into the anterior chamber, vitreous, or beneath the conjunctiva, or its loss from the eye; lodgment of foreign bodies upon or in the lens, and traumatic cataract. When dislocated it is usually accompanied by other lesions, such as rupture of the sclerotic and choroid.

What results from injuries of the lens?

Opacity of the lens, partial or complete, or traumatic cataract. When dislocated it becomes opaque, and is gradually absorbed.

What is the treatment of injuries to the lens?

Dilate the iris thoroughly, keep the eye at rest by a pad or bandage, or, if inflammatory symptoms supervene, it will be necessary to make an iridectomy or remove the lens upon the occurrence of any marked increase in tension.

What is the cause of hemorrhage in the vitreous?

The vitreous humor, after concussion or deep-punctured wounds extending beyond the lens, is apt to suffer from hemorrhage, owing to a rupture of the blood-vessels of the choroid. The vision is seemingly destroyed at once, but after absorption has taken place the vision may be found but little impaired, or, on the other hand, materially affected by floating masses of the fibrinous elements of the effused blood, or be entirely destroyed. Detachment of the retina is a frequent complication of hemorrhage in the vitreous, and makes the prognosis more grave as regards the recovery of vision.

What treatment is advised?

Rest of the eye and the use of cold compresses together with the internal administration of Arnica or Hamamelis to hasten absorption of the effused blood.

What is to be done when foreign bodies find a resting place in the vitreous humor?

When such bodies are small they occasionally become encysted, and the eye escapes further harm for some time at least. As a rule purulent inflammation of the vitreous follows the introduction of foreign bodies into it, with destruction of the eyeball, or the inflammation extends to the other tissues of the eyeball and sets up a panophthalmitis. In some cases the inflammation may be non-purulent and affect only a part of the vitreous, which is followed later by its contraction and a detachment of the retina, and finally atrophy of the globe. In general the treatment consists in the early removal of the foreign body, or the eye containing it, to prevent if possible sympathetic inflammation of the other eye, the danger of which is always great.

How may the choroid be injured?

By rupture from reception of blows upon the eyeball, frequently without external injury to the sclerotic or cornea, and from wounds involving the sclera and sclero-corneal region.

What are the results of choroidal injury?

Hemorrhage into the interior of the eyeball, with sudden and complete loss of vision, which may be temporary or permanent. Detachment of the choroid from

the sclera may occur as a result of injury, and in such an event repair is hopeless, as reattachment does not occur. Inflammatory changes in the choroid and retina frequently result from injuries, and further impair the vision, if it has not been already destroyed.

What is the treatment required?

Absorption of the hemorrhage under the use of Arnica or Hamamelis, and absolute rest of the eye to prevent further complications.

What injuries of the retina may occur?

They usually co-exist with those of the choroid, and are mainly those of detachment from blows or wounds which cause effusion of serum or blood in proportion to the amount of tissue separated.

What is the treatment of detachment of the retina?

Reattachment after injury is rare. Absolute rest in the recumbent position and bandaging of the eye, together with the internal administration of Arnica and Gelsemium, may accomplish much in some cases; yet the prognosis as regards reattachment and recovery of vision is always grave.

General Considerations of Treatment.

In the treatment of disease or injury of the eye and its appendages, there are certain general principles which are more or less applicable to all forms of affections incident to the organ of vision. While accurate and skillful treatment demands an individualization of each case, irrespective of its pathology, yet certain

considerations of extraneous therapeutic measures are necessary in the treatment of both diseases and injuries of the eye. In general these measures consist of prophylactic or hygienic means, and the use of adjuvants.

What may be said of prophylaxis and hygiene?

The eyes should be protected from such hurtful influences as smoke, dust, glaring light, extreme heat, etc., by colored or transparent glasses, eye-shades, a bandage, or by seclusion in a dark room. Protective glasses may be single or double; when single a convex watch crystal, attached by means of adhesive plaster, is ordinarily sufficient to hermetically seal up and exclude from contagion the unaffected eye.

Bandages of thin flannel, merino or antiseptic gauze, 1½ to 2 inches wide and 3 yards long, are to be applied in such a manner as to afford a means of protection or compression and insure rest of the eye; or, a much shorter one may be employed, which is intended only to retain dressings. Seclusion in dark rooms may be necessary in extreme cases. Frequently absolute rest of the entire body is essential, requiring the patient to be confined to his bed. Cleanliness, asepsis, ventilation, regulation of temperature, and often general disinfection, are necessary requisites to the sanitation of the surroundings of the patient.

What forms of anesthesia are used?

Either local anesthesia, which follows the use of cocain hydrochlorate, in 4 per cent. solution, dropped into the eye at intervals of five or ten minutes for three

or four times, or, when this is insufficient, general anesthesia from ether or chloroform is to be employed.

How are bandages for the eye applied?

It is sometimes deemed advisable to prevent motion of the eyeball or give it as much rest as possible with a bandage. To apply a bandage for this purpose, the closed eyelids should be covered by an oval bit of linen upon which a little plain or carbolized cerate has been spread. Then with bits of lint or absorbent cotton the depression below the eye and at the side of the nose is carefully padded until the eye is surrounded by a wall thus formed at its inner and lower portion and raised to the height of the upper margin of the orbit. The end of a roller bandage, an inch and a half wide, is placed at the side of the head above the ear on the side of the affected eye, and the bandage unrolled toward the forehead, then around the head until it again reaches the ear of the opposite side, when it is carried downward and backward across the occiput below the ear of the affected side and brought up over the affected eye, pinned, then reversed and carried downward over the eye below the ear and around to the opposite side of the head, where it is fastened by pins. In some cases it may be necessary to make in this manner several turns over the eye.

Other bandages consist of short lengths of bandage sufficient to retain a dressing or a mass of cotton to lessen the motion of the eye. In the majority of minor cases a folded handkerchief passed over the eye and secured around the head is usually sufficient to protect the eye or retain a dressing.

How and when may the local application of cold be utilized?

In acute inflammation, when it is desired to abort or subdue the severity of the disease, the frequent application of compresses or bits of linen which have been immersed in ice water or laid upon ice, or the use of the small ice-bag or a current of cold water through coiled tubing applied to the eye, is usually grateful and efficient. After injuries or operations the use of cold applications is always indicated.

When and how is heat to be used?

When cold applications become intolerant to the patient, and especially in inflammations of the cornea and iris, in phlyctenular conjunctivitis or keratitis, in ulcerative keratitis, in the declining stages of purulent conjunctivitis, or where it is desired to promote suppuration, the application of heat by use of wads of absorbent cotton or soft linen dipped in hot water as often as they become cooled after application to the eye, the use of hot poultices of small size, or the use of dry heat in the form of heated flannel or a small hot-water bag, is frequently of service and of much benefit.

What are collyria, and how used?

Collyria are lotions, soothing, stimulating, astringent or caustic, applied to the conjunctival membrane of the eye, usually by means of a dropper or pipette, the solution being dropped into the conjunctival sac by everting the lower eyelid, or, when a more thorough application is necessary, the upper lid is everted and the solution applied to it directly by a cotton swab, camel's-hair brush, or dropped from a pipette.

What caustics and astringents may be used?

Caustics are to be applied to the eye with the greatest caution, and only by the surgeon. Nitrate of silver solution should never be used stronger than ten grains to the ounce, and its application should not be repeated if it is not well borne by the conjunctiva. A solution of one or two grains to the ounce forms an astringent which is of value in conjunctival inflammation in some cases, but the use of nitrate of silver in any solution is never indicated when there is any loss of the epithelium or substance of the cornea. Sulphate of copper is a caustic astringent, and is used in trachoma with good effect when its application is so made as to prevent too much reaction. Alum crystal forms a safe and valuable astringent when indicated. Sulphate of zinc, in a two-grain solution, forms a mild astringent, and tannic acid and glycerine, in the proportion of fifteen grains to the ounce, forms a very excellent astringent in trachoma.

What are mydriatics?

Mydriatics are drugs whose physiological action produces dilatation of the pupil of the eye. Atropin, cocain, homatropin, duboisin, and scopolamin are mydriatics.

How and for what purpose are they used?

Mydriatics, usually in aqueous solution of definite strength, are dropped from a dropper directly into the conjunctival sac, pressure being made with the finger over the lachrymal sac for a few moments during their absorption to prevent escape into the nose and throat. Their utility consists in their power of placing the

accommodation of the eye in a state of complete relaxation and rest, and by the dilatation of the pupil so acting upon the iris as to prevent its adhesion to the lens, or even break up adhesions which may have formed during the progress of some plastic inflammation of the iris. Atropin sulphate is usually used in a one per cent. solution for adults and one-half per cent. for children; homatropin in a one per cent. solution, and cocain in four per cent. solution. Other drugs usually require a solution of varying strength in individual cases. All are to be used with care to avoid toxic effects.

What are myotics, and for what purpose are they used?

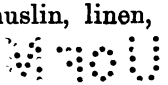
Myotics are agents which contract the pupil, the most important of which are the preparations of calabar bean, the sulphate and salicylate of eserin, and the hydrochlorate of pilocarpin. Eserin is usually prescribed in one-half to one per cent. solution, the frequency of its instillation in the eye being determined by the effect produced or desired.

What dangers sometimes result from the use of such mydriatic or myotic drugs?

In susceptible individuals, or where a too free use of any of these drugs has been made, toxic symptoms or systemic poisoning may occur, which necessitates a discontinuance of the drug and the employment of measures instituted to combat its toxic action.

How is the eye to be cleansed?

In removing discharges from the eye, small bits of old muslin, linen, camel's-hair brushes or absorbent



cotton, or the subpalpebral syringe filled with some disinfecting or antiseptic fluid, may be used.

Diseases of the Orbit.

What are the orbits?

Two bony cavities which contain and protect the eyeballs. They are pyramidal in shape, with the bases outward and forward. The apices are formed by the optic foramina, which connect the orbit with the cranial cavity. The depth of the orbit is about one and three-fifth inches. The roof separates the brain and frontal sinus from the orbit. The floor separates the orbit from the antrum of the superior maxillary. The bony orbits, in addition to the eyeball with its muscles, nerves and blood-vessels, are filled with fat and connective tissue.

What are the principal diseases of the orbit?

Orbital cellulitis, capsulitis, or inflammation of Tenon's capsule, periostitis with caries and necrosis, diseases of the blood-vessels, and tumors.

What symptom is common to many orbital diseases?

Exophthalmos, or protrusion of the eyeball.

What are the causes of exophthalmos?

An increase in the contents of the orbit from inflammatory exudations, effusion of blood, tumors, inflammation of the walls of the orbit, diseases of the lachrymal gland, diseases of the surrounding cavities of the orbit, or an increase in the size of the eyeball itself from various causes, paralysis of the recti muscles, and injuries which cause its dislocation.

How may exophthalmos serve as a means of diagnosis?

The direction of the protrusion, together with the condition of the eyeball as regards its shape and mobility, designates the part of the orbit in which the lesion is located.

What is orbital cellulitis or abscess of the orbit?

An inflammation and suppuration of the cellular tissue of the orbit.

Is it of serious import?

It is an affection of much gravity, being usually destructive to vision, and not infrequently productive of death.

What is the etiology of orbital cellulitis?

Its productive causes are more frequently from traumatism of the orbit, as laceration of the eyeball, contusion, or puncture of the tissues of the orbit from foreign bodies or operations upon the eye, as after tenotomy of the muscles. More rarely it appears as a complication of periostitis, extension of erysipelas, or as a metastatic abscess in pyemia or puerperal fever, and incidental to small-pox and meningitis.

What are the symptoms and diagnosis of orbital cellulitis?

The disease commences with intense pain, usually throbbing in character, in and around the eye, worse on pressure, and extending to the side of the head and muscles of the neck. The lids become red, hot and swollen; fever and not infrequently brain symptoms occur. The eyeball protrusion is generally directly forward, the motions of the ball more or less completely lost, and the conjunctiva thick, red and swollen.

The vision is impaired by the pressure upon the optic nerve or by its inflammation.

What are the resulting tissue changes?

Exudation from overcharged blood-vessels and cell proliferation; this results in a matting together of the muscles and other tissues of the orbit.

To what may the disease extend?

To the sheath of the optic nerve, with resulting neuritis, or the pressure of the contents of the orbit may interfere with the circulation in the nerve, inducing atrophy of the disc.

What other results may occur?

The chemosis or swelling of the conjunctiva may be sufficient to cause sloughing of the cornea, or the whole eyeball may participate in the inflammatory action. The formation of pus is characterized by rigors, and is diffused through the orbit or gradually makes its way toward the front, where fluctuation may be found behind the lids, or the pus may break through the lids or conjunctiva.

What complications may ensue?

Panophthalmitis, or inflammation of all the tissues of the eyeball; or, by the extension of the inflammatory process backward, the membranes of the brain may become involved, with the production of cerebral symptoms.

Give the differential diagnosis of orbital cellulitis.

The disease is most likely to be mistaken for the first stage of purulent conjunctivitis, but the absence of any discharge from the chemotic conjunctiva in

orbital cellulitis, together with inability to move the eye, will readily distinguish it from the former. From panophthalmitis it differs in the more or less fair condition of vision; from periostitis, by the absence of diplopia and the equal displacement of the eyeball; from tumors and malignant growths of the orbit, by the presence of acute inflammatory symptoms and pain.

What is the duration of this disease?

In the acute form it usually reaches its crisis in from eight to fourteen days, but some cases may become subacute or chronic and last for months.

Upon what does the prognosis depend?

It depends upon the severity of the inflammation, extension of the disease, amount of destruction of tissue involved, and complications which arise. The prognosis is always grave when the inflammation extends to the eyeball, as pus forming in its interior will require an incision through the anterior portion of the eyeball for its discharge, and destruction of the vision and atrophy of the eyeball results. The possibility of optic nerve atrophy from pressure or extension of the inflammation of the disease to its sheath, loss of motion of the eye or atrophy of the eyeball from extensive destruction of the orbital tissue, or necrosis of the bones of the orbit, increases proportionately the gravity of the prognosis.

What is the treatment of orbital cellulitis?

This consists in the constant application of ice-bags or cold compresses in the early stages; later, when suppuration is inevitable, hot compresses and poultices are

indicated. As soon as pus is formed, or fluctuation discernible, a free incision with a long double-edged cataract knife should be made close to the wall of the orbit and a drainage tube inserted. If the diagnosis of pus is not positive and the pain is great, an incision with a linear cataract knife should be made along the upper or lower wall, as the indications may present, and if pus follows the knife, a drainage tube or tent should be inserted.

What are the indications for the principal remedies in orbital cellulitis?

Aconite.—When the inflammatory symptoms first appear. The lids are swollen and tense, the conjunctiva chemotic, and much heat and general sensitiveness of the eye and surrounding parts, with general febrile excitement, are present.

Belladonna.—Oftentimes follows the use of Aconite in the first stages, and presents the same indications as regards the eyes, except that the hyperemic condition of the lids is usually of a darker hue and general cerebral congestion is present.

Apis mellifica.—In the first stage, when there is much edema of the lids and conjunctiva, with stinging, shooting pains in and around the eye, with a drowsy, thirstless condition.

Rhus toxicodendron.—One of the most valuable remedies for the first stage of cellulitis, whether arising from injury or after operation, or from other causes. The lids and conjunctiva are edematously swollen, but usually harder to the touch than under

Apis. The pains may be of any description. The general restlessness is very marked.

Phytolacca decandra.—Stands next to Rhus tox. in value for cellulitis, but suits subacute and chronic cases better. The pain and inflammatory symptoms are all more moderate. The lids are hard, as is also the orbital tissue, and of a purple hue. Additional benefit is derived from the external applications of cold compresses, wet with dilute phytolacca tincture, before the suppurative stage has been established. Later, much relief may be obtained by the use of a poultice made from the phytolacca root.

Hepar sulphur. — For the suppurative stage, or when it is inevitable. The lids are swollen, red, and extremely sensitive to touch or cold applications. The pains are mostly throbbing.

Mercurius solubilis. — This remedy will often shorten the suppurative stage, or after the pus has been evacuated, or when it becomes thin in character, the reparative process will be hastened by its use.

Kali iodidum.—Very useful in those cases of partial orbital cellulitis occurring in syphilitic constitutions.

What other remedies may be useful in orbital cellulitis?

Arsenicum, Bryonia, Lachesis, Silicea and Sulphur.

Describe orbital periostitis.

An inflammation of the periosteum which may affect any portion of the orbital walls, more frequently the margin of the orbit. It may be acute or chronic.

What is the etiology of orbital periostitis?

Its causes are traumatism, syphilis, periosteal inflammation of other cavities through continuity of tissue, exposure to cold in ill-nourished and low conditions of the system.

What are the symptoms and diagnosis of orbital periostitis?

If acute it is often difficult to distinguish from orbital cellulitis, with which it is always accompanied to a greater or less extent. The cellulitis is usually localized, and the tendency to localization is greater the more chronic the periostitis. Where an acute periostitis arises from some lesion of the orbital walls, the periosteum is detached by the formation of pus beneath it. The displacement of the eye is in the direction opposite to the side affected, while the motion of the eyeball is limited in the direction of the side affected. There is increased sensitiveness and pain on pressure of the finger upon the eyeball or just within the orbital margin. The chronic form is more common, and may continue for years. Exophthalmos and diplopia are commonly present, and in old cases a fistulous opening from the conjunctival sac exists upon the surface of the lids or upon the cheek. Careful probing through this opening will reveal the roughened surface, or necrosis of the bone.

What is the differential diagnosis of orbital periostitis?

Periostitis is to be differentiated from orbital cellulitis by the more acute process of the latter, the greater protrusion of the eye, the loss of mobility, and defective vision; from orbital tumors, by the absence of pain

and inflammation; from malignant growths, by the early implication of the surrounding tissues and lids; from Basedow's disease, by the staring appearance of the protruded eyes, with motion of the eyeballs and absence of inflammation of the latter.

What is the treatment of orbital periostitis?

This consists in the prevention of the extension of the diseased condition by the use of remedies, early evacuation of the pus when formed, and attention to the patient's general health. In the acute form applications of moist heat by compresses or poultices may lessen the pain, but are usually of little value. Rest in bed and the strength sustained by proper diet is essential. In the chronic form, nourishing food, fresh air and avoidance of exposure to wet or cold are necessary in addition to remedial measures.

What are the indications for the more commonly indicated remedies?

Asafetida.—The parts around the orbit are bluish, with great sensitiveness to touch. It proves very useful in relieving both the pain and inflammation.

Aurum muriaticum.—Periostitis and caries, with a tendency to exostosis in syphilitic patients; the pains are boring in character, excruciating, and referred to portions of the affected bone; nightly aggravation.

Kali iodidum.—May be indicated in all forms of periostitis, but particularly so in the syphilitic variety. The pains are worse at night, and vary much in character, and often may be very slight.

Ferrum phosphoricum.—This remedy is often of

value in localized periostitis occurring from traumatic causes or in those of strumous habit.

Calcarea phosphorica.—As a nutrition remedy is often of much benefit in cases exhibiting slight reactive power.

Mercurius solubilis.—Often indicated in cases of periostitis and caries when the general cachectic condition presents the characteristic symptoms of the remedy.

Silicea.—In caries where fistulous openings leading to the diseased bone are present. The parts are hard, swollen, bluish-red, and the pus is usually offensive.

Calcarea fluorica, Nitric acid, Calcarea carbonica, Hecla lava and Sulphur, and other remedies may also be indicated.

What are the causes and symptoms of caries of the orbit?

It may result from periostitis or cellulitis, or take place in consequence of direct violence, particularly in strumous or syphilitic cases. Owing to its exposed condition, the margin of the orbit is more frequently the seat of the trouble. In the acute condition the lids become edematously swollen, frequently closing the eye, the conjunctiva inflamed, and an abscess points upon the upper or lower lid, usually near the outer canthus. On opening the abscess, dark-colored and badly smelling pus is discharged, and a fistulous opening results if the caries is not cured.

What is the treatment of caries?

The abscess should be opened as soon as possible and a drainage tube introduced, and if there is necrosis, the dead bone removed as soon as loosened. The

remedies likely to be needed are those indicated in periostitis.

What is capsulitis?

It is an inflammation of Tenon's capsule, and is a very rare disease. It presents slight protrusion of the ball, deep injection of the sclerotic, and accompanying chemosis of the conjunctiva, with slight loss of motion in all directions. The absence of inflammatory changes in the cornea, iris, or conjunctiva will differentiate it from diseases of these tissues. The causes which produce it are direct injuries to the capsule, as in tenotomy for strabismus, or lacerated wounds of the eyeball, and is occasionally idiopathic in rheumatic subjects.

What is the prognosis and treatment of capsulitis?

It usually runs a mild course, and requires for its treatment warm fomentations with intervals of moderately tight bandaging. The remedies most likely to be of service are Rhus toxicodendron, Kalmia latifolia, Bryonia, and Phytolacca.

What is exophthalmic goitre?

A disease characterized by protrusion of the eyeballs, hypertrophy of the thyroid gland, cardiac dilatation, and easily excited palpitation and rapid pulse.

By what other names is it known?

As Basedow's and also as Graves' disease.

What is its cause?

It is probably due to some disturbance of the sympathetic nervous system, and frequently arises from nervous shock, fright, and from reflex irritation of the

genital organs. It is more frequent in females, occurring commonly at about the age of puberty, but may occur in either sex or in advanced age.

What are its ophthalmic symptoms?

Prominence or protrusion of the eyeballs with more or less retraction of the upper lids and a staring expression of the eyes, which becomes more marked when the patient looks downward. In some cases the protrusion of the eyeballs is so great that the eyelids cannot cover them, so that the cornea becomes ulcerated as a result of the undue exposure.

What is the treatment of exophthalmic goitre?

For the exophthalmos, when extreme, it is necessary to protect the exposed cornea from irritation as far as possible. To do this, the frequent application of some oily substance like vaseline to the eyeball may be sufficient, or it may be necessary to close the lids by means of adhesive plaster or even sutures. The treatment for the disease must be determined by the character of its prominent symptoms; if the sympathetic, the thyroid gland or the heart present leading symptoms, the treatment is to be directed towards their relief.

What tumors are found in the orbits?

Both benign and malignant, which may be developed in any of the various structures within the orbit, its walls or by extension from the surrounding cavities. The prominent symptom of their presence is the protrusion of the eyeball, pain usually characterizing their malignancy. Their location is determined by the

direction of the exophthalmos and by palpation of the orbit through the lids. The character of the tumor is determined by its symptoms or by microscopical examination of a portion of its structure when obtainable.

What is the treatment of tumors of the orbit?

In the case of cystic tumors the evacuation of their contents by incision or aspiration with the use of injections to destroy their secreting walls as far as practicable; in the case of more solid tumors, particularly if malignant, their early removal is indicated, and the removal of the eyeball and the entire contents of the orbit may be necessary in sarcoma or exostosis.

What does pulsating exophthalmos indicate?

When with protrusion of the eyeball there is perceptible pulsation, it is due to the development of aneurism within the orbit, cranium or surrounding cavities. It is not generally amenable to treatment, but ligation of the carotid artery may be indicated.

What bearing have diseases of the frontal, ethmoidal and maxillary sinuses upon the contents of the orbit?

Diseases of any of the surrounding cavities may disturb the tissues of the orbit and produce exophthalmos from inflammation, from distension by accumulation of secretion, or from the development of new growths within the sinuses.

Diseases of the Lachrymal Apparatus.

What is meant by the lachrymal apparatus?

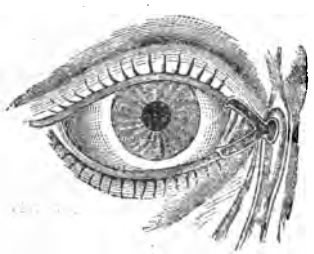
The lachrymal gland or secreting portion, with the accessory conjunctival glands, and the canaliculi, sac and nasal duct which constitute the conducting portion.

What is the function of the lachrymal apparatus?

That of lubricating and cleansing the anterior portion of the globe of the eye and conducting the excessive secretions through the duct into the nose.

Give in brief its anatomical relations.

The lachrymal gland consists of two portions, superiorly and inferiorly, of which the upper is the larger portion and is located at the upper and outer side of the orbit in the depression immediately beneath the roof of the orbit, known as the fossæ lachrymalis.



Puncta, canaliculi and lachrymal sac.

With the conjunctival sac it communicates by from six to ten ducts. The lower portion consists of a group of small glands arranged in a row near the external canthus above the fornix conjunctivæ, being closely united to the back of the eyelid and presenting small lobules which open into the conjunctival sac at

its upper and outer portion by from 12 to 14 ducts. The secretion from these glands, a salty fluid known as the tears, is distributed over the eyeball, collected at the inner canthus and passes into minute openings, the puncta, of which there are two, opening into the canaliculi at the inner angle of the eye, through which the watery fluid is carried by these narrow canals to the lachrymal sac and thence through the nasal duct to the nose. The puncta in their normal condition are directed against the eyeball. The lachrymal and nasal duct together form a passage about one inch in length, which is lined with mucous membrane continuous with the conjunctiva of the eye and mucous lining of the nose. The lachrymal sac, an expanded portion, is located in the depression formed by the lachrymal and superior maxillary bones, situated between the tensor tarsi posteriorly and the tendo oculi anteriorly. The duct, continuous with the sac, follows a bony canal in the nose opening beneath the inferior turbinated bone.

What is dacryoadenitis?

An inflammation of the structure of the lachrymal gland, which occurs only rarely and presents an acute and chronic form, the latter being the more common. The causes are traumatism, exposure to cold or wet, or infection from particles of dust, etc. It is characterized by tenderness, pain, local heat, redness of the parts and swelling at the outer angle of the lids. If the enlargement is great a downward and inward displacement of the eyeball results. Unless the inflammation be acute, the tumor is not painful or sensitive to the touch. The

disease may end in resolution or suppuration; in the latter case the pus is discharged through the conjunctival sac or a fistulous opening forms in the lid.

What is the treatment of dacryoadenitis?

In the acute form Aconite or Belladonna with cold compresses may cause resolution. If suppuration threatens, hot fomentations and poultices will be required, and as soon as pus is formed an incision for its removal should be made. During suppuration, Hepar sulphur, Mercurius and Silicea are to be considered. In the chronic form the enlargement may be reduced by such remedies as Calcarea iodidum, Baryta iodidum, Kali iodidum and Phytolacca. Extirpation of the gland may become necessary.

What is dachryops?

A small bluish tumor formed by the distension of one or more of the ducts of the lachrymal gland from the closure of its conjunctival opening. The remedy is excision of a portion of the cyst wall.

What tumors may affect the lachrymal gland?

The lachrymal gland may be the seat of cystic degeneration and of sarcomatous or other morbid growths. An early recognition of the tumor is necessary and removal of the gland indicated. The mucous follicles of the conjunctiva are usually sufficient to keep the eye moist.

What is epiphora or "watery eye?"

A term used to signify an overflow of tears upon the cheek from hypersecretion, due to irritation, inflammation or obstruction to the flow of the lachrymal fluid

from the eye by eversion of the puncta or stricture of the lachrymal duct.

What causes eversion of the puncta?

Inflammation with thickening of the lids, or loss of power of the orbicularis muscle.

What are lachrymal strictures?

They are obstructions to the flow of tears occurring in any of the lachrymal conduits of one or both eyes and may result from mucous, fibrous or bony constriction.

What are the productive causes of lachrymal stricture?

They are various; traumatism and resulting cicatrix in the region of the lids, impaction and consequent inflammation of foreign bodies, fungous growths, earthy deposits and extension of chronic catarrhal condition from the nose or conjunctiva.

What are the symptoms of stricture?

Besides the overflow there is frequently a small

Mucocele.

tumor-like prominence of the lachrymal sac, a mucocele, found to the nasal side of and just below the inner can-

thus. Pressure upon this causes a filling of the inner canthus with viscid mucus or muco-pus, mixed with tears, which passes through the canaliculi and puncta, or if the stricture gives way under the pressure, the contents of the tumor passes to the nose.

Give the treatment of lachrymal stricture.

Bony strictures are usually forlorn cases as they are commonly impermeable. The careful selection of a homeopathic remedy may improve the condition. In all forms of stricture, treatment should be primarily directed toward an improvement in the condition of the mucous membrane lining the passages by the use of such remedies as Petroleum, Argentum nitricum, Stannum, Pulsatilla, Silicea and Mercurius when the puncta or canaliculi are not at fault. The adjunct use of a mild collyrium as a lotion of borax gr. x ad f℥j, or calendula tincture gtt. x ad f℥j of water, or boracic acid gr. viij ad aqua dest. f℥j, injected into the lachrymal sac by means of a lachrymal syringe through the puncta is often necessary. Should the obstruction not disappear under this treatment, recourse must be had to the use of a small probe, and if necessary the canaliculus must be slit to enable the use of larger probes or a knife to divide the stricture.

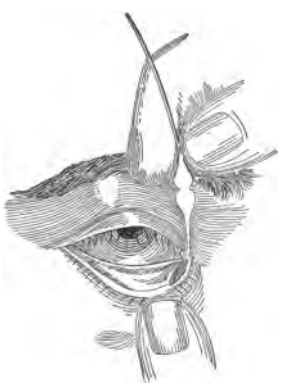
How is the operation of slitting the canaliculus performed?

By the use of a probe-pointed canaliculus knife, which is introduced into the punctum, the lower one being usually selected; the handle of the knife is depressed and the blade pushed forward until its probe point rests against the wall of the sac upon the lachry-

mal bone after having passed through the opening of the canaliculus into the sac. The handle of the knife is now raised and the canaliculus is split upon the blade of the knife, so as to convert the canaliculus into an open gutter with the opening directed against the inner edge of the lid. By separating the edges of the incision daily for three or four days the opening becomes permanent and the use of the lachrymal syringe or probes is rendered more easy and efficient.

What are lachrymal probes and how are they to be used?

Lachrymal probes are instruments of various kinds which are used to determine the location of strictures and aid in their dilatation. The eye having been cocainized, the selected probe is introduced carefully through the punctum, if necessary a previous slit of the punctum or canaliculus having been made, and then passed along the canaliculus into the sac, then following as nearly as possible the general direction of the nasal duct, which is downward, outward and slightly backward, until the end of the probe rests upon the floor of the nose. Probes are to be passed every few days and their size increased from time to time, until the stricture has been overcome.



Lachrymal probe introduced.

How are strictures divided by the knife?

The blunt-pointed knives of Stilling, Agnew, and others, which are specially devised for the purpose, are passed into the sac in the same manner as a probe, and when the stricture is reached the knife is passed through it in different directions until three or four divisions have been made.

Describe the method of electrolysis.

This method requires the use of a galvanic current of electricity and specially constructed probes for its use. The negative pole is applied to the probe, the positive pole to some near and not too-sensitive part of the body. After all connections have been made, the current is turned on and gradually increased until sufficient electrolytic action takes place to permit of the probe's passage through the stricture. Great care must be exercised not to use a current strong enough to cauterize the parts

What treatment should follow these operations?

The sac and ducts should be syringed with some antiseptic lotion and the application of cold compresses over the part if there is pain or a tendency to inflammatory reaction.

What is dacryocystitis?

Any inflammation of the lachrymal sac, but a term commonly referred to a violent inflammation of the sac and surrounding tissues with formation of pus; an abscess of the lachrymal sac. The milder forms of dacryocystitis are usually the accompaniment of acute or chronic disease of the conjunctiva or nasal mucous

membrane, and tend to the formation of strictures. The abscess occurs as a result of stricture of the duct, recent or old, when from some cause, as inception of cold or unusual irritation, a violent inflammation of the sac is occasioned.

What are the symptoms of abscess of the lachrymal sac?

If there has been a distension of the sac before, it increases in size, the skin covering is red and inflamed, there is pain and tenderness of the part to touch. The eyelids and the cheek become swollen, red and edematous, and the side of the face presents the appearance of an attack of erysipelas, for which it is often mistaken. A previous history of overflow of tears, mucocele, or of lachrymal stricture, aids to diagnose the affection as one of the lachrymal sac. In the course of a few days the abscess points at the lower portion of the sac and the pus is discharged externally upon the face.

What is the treatment?

The effort is to be made to control the inflammation by use of cold compresses or ice-bags together with the internal administration of Aconite, Belladonna or Veratrum viride and thus abort the attack. The immediate slitting up of one or both canaliculi, before the edema of the lids has become so great as to make it impossible, will cause a rapid subsidence of the inflammatory symptoms if done in conjunction with the above treatment. As soon as pus forms, the temperature of the topical applications must be changed and hot fomentations of a decoction of calendula flowers or a

diluted tincture of veratrum vir. gtt. xx ad f℥j applied continuously together with the internal administration of Hepar, Pulsatilla or Silicea as may be indicated. When the abscess points, a free incision directly into the sac should be made.

What is a lachrymal fistula?

A term commonly applied to an opening from the lachrymal sac to the face, which persists after the discharge of pus from an abscess of the lachrymal sac; its cure being obtained by removal of the stricture of the duct that caused it.

What is dacryocystoblennorrhea?

A catarrhal inflammation of the lachrymal sac and duct, generally secondary to extension of catarrhal inflammation of the nose or conjunctiva, most always accompanied by stricture of the sac or duct, with the formation of a mucocele and abundant secretion of muco-pus or pus.

What are its symptoms?

More or less feeling of discomfort in the region of the lachrymal sac, some overflow of tears or their accumulation at the inner angle of the eye, followed later by a thick mucus discharge appearing at the inner canthus, and which in time becomes purulent. If neglected, the disease progresses and gradually distends the lachrymal sac until a mucocele is produced. Pressure upon the sac empties the contents through its outlet into the eye or nose, but in a short time the sac becomes filled and distended as before. The progress

of the disease is slow, but after a time the accumulated secretion may undergo decomposition and become so irritating as to cause acute attacks of conjunctivitis or exacerbation of the inflammation of the sac with abscess or resulting fistula.

What is the treatment of blennorrhea of the sac?

The removal of any obstruction to the normal flow of tears and the prevention of the accumulation of secretions in the sac, cleansing the passages frequently with mild antiseptic lotions with the lachrymal syringe, avoidance of exposure of the eyes to cold winds and over-taxation, also treatment of any catarrhal condition of the mucous membrane of the nose as well as that of the eyes. In all cases the internal administration of homeopathic remedies is of great value.

What remedies are found useful in these cases?

Aconite.—Indicated when the mucous membrane presents the same hypertrophied condition which was present in the conjunctival affection which preceded or accompanies it.

Euphrasia.—Indicated in similar conditions to Aconite and frequently follows the latter when the discharge becomes thick, yellow and acrid.

Pulsatilla and Calcarea carbonica.—When there is a profuse, thick and bland discharge. The concomitants deciding the choice.

Argentum nitricum.—Catarrh of the lachrymal sac. When the discharge is profuse and the caruncle and semilunar folds appear red and inflamed.

Petroleum.—This remedy has a marked action upon

the mucous membrane of the lachrymal sac when the obstruction is due to thickening of the mucous folds.

Calendula.—Particularly useful in obstinate cases, when the blennorrhea continues after the duct has been opened and the stricture tends to reform, and is to be applied locally as well as internally.

Stannum.—Cures some cases of blennorrhea of the sac when there is profuse yellowish-white discharge with sharp pain or itching of the inner canthus, particularly at night.

Arsenicum iodatum.—Proves useful in curing obstructions of the duct dependent upon acute inflammation and swelling of the nasal mucous membrane. It may be suitable to those cases of blennorrhea of the duct accompanied by a dry ulcerated condition of the nostrils.

Hepar sulphur.—Inflammatory conditions of the sac with sensitiveness to touch and free discharge of pus, with or without an opened canaliculus.

Mercurius.—The discharge is thin, acrid, and often excoriates the lid margins, or the cheek where the overflow comes in contact with it.

Silicea.—There is a bland discharge, or one of decomposed mucus and pus from the distended sac after the canaliculus has been opened and probing begun. It may also be indicated in the recurrent inflammatory attacks of old cases of blennorrhea of the sac.

Many other remedies are recommended, and when indicated are of service in improving the condition—such as Arum triphyllum, Aurum muriaticum, Calcarea,

Cuprum, Alumina, Hydrastis, Fluoric acid, Kali iodidum, Nux vomica, Sulphur, and Zincum.

Diseases of the Lids.

What is the general anatomy of the lids?

The eyelids are movable portions of integument, strengthened toward their free margins by thin lamina of dense fibrous tissue. Externally they are continuous with the cuticle of the forehead and face; internally, lined by the conjunctiva, which is reflected onto the eyeball. The upper eyelid is larger than the lower, the whole of the cornea being covered by it when closed, and it is chiefly by the elevation of the upper lid that the eye is opened, the movement being effected by the levator palpebræ muscle, which arises in conjunction with the four recti muscles at the apex of the orbit to be inserted by a broad expansion into the tarsus of the lid. At the outer and inner angles or canthi the lids are united, the interval between the canthi being termed the fissura palpebrarum, upon which depends the apparent size of the eye. The edge of each lid is flattened except at the inner canthus, where it becomes somewhat rounded and changed in direction. At this point on each lid is found a conical elevation, the papilla lachrymalis, upon the top of which is found a minute opening, the punctum lachrymalis. Throughout the whole extent, except at the inner canthus, the lids are applied by the orbicularis muscle directly to the surface of the eyeball. The skin covering the lids is thin and delicate, presenting

fine, downy hairs and sudoriferous glands. At its free margin where the cilia present it joins the conjunctiva lining the inner surface. Beneath the skin is found the fibres of the orbicularis muscle, loose connective tissue, and the dense fibrous plates, or tarsi, which attach the lids to the margin of the orbit.

Where are the meibomian glands?

On the posterior surface, immediately below the conjunctiva of the lids, in grooves in the tarsi. They number from thirty to forty in the upper lid and twenty to thirty in the lower lid, and are modified sebaceous glands which open by minute orifices upon the free margin of the lid, discharging a thin, fatty secretion, which tends to prevent adhesions of the lids.

What are the cilia?

The eye-lashes, or cilia, are strong, short, curved hairs arranged in two rows along the margin of the lids at the line of union of the cuticle and conjunctiva. The upper lashes are more numerous and stronger than the lower and curved in opposite directions.

What is blepharitis acuta?

An acute inflammation of the connective tissue of the eyelids, or abscess, arising from injuries to the lid or supervening upon erysipelas, or it may occur without apparent cause.

What are its symptoms?

The upper lid is more commonly the one affected; the disease comes on rapidly, with great redness, heat, swelling, and sensitiveness to touch. The lid becomes

enormously distended; soon fluctuation is discernible; the abscess points, and when opened a discharge of thick, creamy pus follows and the swelling and inflammation rapidly subside. Occasionally the abscess discharges on the conjunctival surface of the lids. Abcess forming at the inner angle of the eye is termed *anchylops.* If the abscess open through the lid margin of the inner canthus it is called *egilops.*

What is the treatment of acute blepharitis?

In the early stages the use of ice-cold compresses, with the internal administration of Aconite, Arsenicum, Apis, or Rhus, according to the indications, will enable us to cause resolution without the formation of pus. Should suppuration have taken place, hot compresses or poultices, together with the internal administration of Hepar, Calcarea hypophos., or Silicea will be required to hasten the formation of pus or cause its absorption As soon as the abscess points or fluctuation is determined an incision parallel to the lid border is to be made with a curved bistoury or cataract knife. Some deformity to the lid usually remains after the subsidence of the inflammation.

What may be said of carbuncle and malignant pustule?

They are rarely met with in the eyelids. They present the same features as when occurring on other portions of the body, and require treatment on general principles. Arsenicum, Lachesis, Rhus, and Silicea are the remedies likely to be required, with stimulating diet and every effort made to sustain the patient's

strength. The destruction of tissue is apt to be very great and deformity of the lid results.

When does erysipelas of the lids occur?

Usually as an accompaniment of facial erysipelas, but the lids may be the starting point, and erythema or hyperemia of the lids, which present a bright scarlet color with heat, is often the precursor of erysipelas which may involve the head and face. Where erysipelas attacks the lids the swelling is usually soft, with considerable edema and throbbing pain. Several abscesses may form, and the destruction of the lids will be consequently great. Complications to vision are apt to occur from extension of the inflammation to the orbital tissue; sloughing of the cornea may result or the inflammation extend along the optic nerve to the brain, causing optic neuritis and meningitis. The treatment of erysipelas of the lids is that of the disease in other portions of the body.

What is hordeolum, or stye?

An acute circumscribed inflammation of the cellular tissue of the free border of the lid, appearing close to or involving one or more cilia. Its appearance is due to disturbances in the general system, or the exposure of the eye to cold winds or their over-use when suffering from uncorrected errors of refraction. At first a small red and hard swelling, very painful to touch, it soon causes much inflammation and swelling of the part of the lid in which it is located, or even of the entire lid. It becomes fully developed in three or four days; on its summit a yellowish point appears,

which usually ruptures and gives exit to a little pus or necrosed cellular tissue. One or several may appear at the same time, or one may follow another at longer or shorter intervals.

What is the treatment of styes?

Efforts to abort styes meet with poor success. Hot compresses to hasten formation of pus, which may then be evacuated by a slight incision or left to break itself. Pulsatilla, Hepar sulphur or Mercurius prevent the extension of the inflammation, shorten the course of the attack, and hasten resolution. Graphites, Sulphur, Calcarea carb., Staphisagria, and other remedies, when indicated by the general symptoms, together with improvement of the general tone, correction of errors of diet, and the use of proper glasses will do much to prevent the recurrence of styes.

What is a chalazion?

A chalazion is a small, firm, immovable tumor, hemispherical in shape, which develops in the tarsus and arises from closure of the opening of a meibomian gland, with retention and alteration of its normal secretion. When of spontaneous origin it usually disappears in a few days without treatment; when, as is usually the case, its growth is slow, its absorption requires time. The development of the tumor may stop and remain stationary for an indefinite time, its size varying from a large pin's head to that of a large pea, and may be single or multiple. The eversion of the lid usually shows a thinning of the cartilage over its site, and the conjunctiva appears bluish at that

point, or a projection like a granuloma appears. Defective general nutrition and chronic inflammatory irritation of the lid edges are the more common causes of its appearance.

What is the treatment of a chalazion?

The internal and external use of Thuja, Mercurius iodidum or Staphisagria may cause their disappearance, but the most rapid and satisfactory method is by an incision through the conjunctival surface over the growth after eversion of the lid and the removal of the contents of the cyst with the aid of a scoop made for that purpose. Sometimes a crystal of resorcin or a minute bit of sulphate of copper may be introduced into the evacuated cyst to aid in the destruction of its walls. In some cases it is necessary to open the incision for several successive days to prevent reaccumulation. Treatment is also to be directed toward the improvement of the patient's nutrition when found defective.

What is blepharitis marginalis?

A chronic inflammation of the free edge of the lids, leading to the formation of small pustules, superficial ulcers and excoriations.

What are the symptoms?

In the early stages the patient complains of more or less weakness of the eyes; that the lids stick together in the morning, and that there is much itching after prolonged use of the eyes. The affection usually begins with the appearance of a few hard crusts at different portions of the lid edge among the cilia, gluing

several of them together. When these masses are removed, small reddish spots or superficial ulcers are revealed. The follicles of the cilia become involved, thickening of the edge of the lid occurs, the puncta closed, giving a blear-eyed expression characteristic of the advanced stages of this affection. Madarosis or bald lids may occur from destruction of the bulbs of the cilia.

What are the causes of blepharitis?

It is very common in childhood, particularly in children of a strumous habit, and as a sequel of measles and scarlet fever. Errors of refraction, conjunctivitis and obstructions of the lachrymal passages form frequent causes.

What is the treatment of blepharitis?

Remove if possible all sources of irritation, and correct refractive errors with glasses. If a chronic conjunctivitis is present, it must receive attention at once, and if lachrymal obstructions exist they must be removed. The local treatment consists in the removal of the incrustations of the lids two or three times a day with warm borax water, followed by the application to the lid edges of some oily substance, as vaseline or a stimulating ointment made from the yellow oxide of mercury and vaseline (gr. viij ad ℥j). A very necessary feature of the treatment is that the edges of the lids should be kept clean. Occasionally the presence of lice (*Phthiriasis ciliarum*) simulates blepharitis or causes it. The lice are to be removed and the lid margins anointed with mercurial ointment

to prevent their redevelopment. Attention is to be given to the improvement of the patient's general tone, and for this purpose the use of homeopathic remedies is of great value, and at the same time their action in the cure of the local condition is often remarkable.

What are the indications for the most prominent lid remedies?

Aconite.—Indicated in an acute attack, resulting from exposure of the eyes to dry cold winds. The lid margins are swollen, hot and dry, and there is more or less inflammation of the conjunctiva accompanying.

Graphites.—The action upon the edges of the lid is very marked, and it is perhaps the most useful remedy we possess for the chronic form of blepharitis, particularly when occurring in strumous subjects and accompanied by moist, fissured and easily bleeding, eczematous eruptions on the cheeks or behind the ears. The swelling of the margins of the lids is variable, in color pale red, and the lid edges are crusted with dry scabs which cover spots of ulceration, or numerous fine scales are found on the skin and among the cilia. There is a sensation of itching, burning and biting of the lids. In many cases there is a fissured condition of the skin of the outer canthus which bleeds readily from rubbing or opening the eyelids. The cure is hastened by the application of graphites ointment to the lids at night.

Mercurius.—The various forms of mercury are extremely useful in blepharitis, the Mercurius solubilis or vivus more frequently perhaps than the others. The lids are much thickened, red, and often ulcerated, with

sensitiveness to touch, heat and cold. The lid conjunctiva is hyperemic, or inflamed, with an acrid lachrymation which increases the irritation of the lids. There is an aggravation of the whole condition from exposure to light and heat, or in the evening from artificial light. The local application of an ointment containing hydrargyrum precip. alb. or mercurius iod. flav. gr. i-ij ad vaseline 3j will be found very useful. Mercurius corrosivus and protiodidus present similar symptoms, but in a more marked degree, and the latter when there is a pustular eruption on the parts about the eye or upon the conjunctiva.

Sulphur.—Suitable in a large number of cases occurring in scrofulous children where the disease is occasioned by the debility following the exanthematous diseases, or appears as the accompaniment of eczema of the face or head, for which Sulphur would be indicated. The lids are red, swollen, with numerous small points of suppuration or ulceration along the edges. The characteristic pains are fine, sharp and sticking, though itching, biting, burning, and many other sensations may be present. There is usually an aggravation from wet applications to the parts.

Pulsatilla.—In cases arising from some gastric derangement dependent upon consumption of fatty foods; there is a great tendency to the formation of styes, and frequently acne of the face. The swelling and redness of the lids may vary, as there is usually a rather profuse, bland discharge from the conjunctiva which agglutinates the lids during the night. Itching and burning are complained of, with a general evening

aggravation and from a close or warm atmosphere, with relief from fresh cool air.

Arsenicum.—Blepharitis occurring in cases where the general condition presents debility, restlessness, thirst, nightly aggravation, etc. The lids are often puffed and their edges very red and excoriated by the acrid lachrymation which is a frequent accompaniment of the condition; again, the lids may be smooth, red, and shed numerous scales. The pains are burning in character.

Calcarea carbonica.—Especially adapted to blepharitis in fat, unhealthy children who perspire much about the head. The lids are swollen, edematous and red, with a thick, excoriating, purulent discharge, accompanied by great itching and burning of the lid margins, particularly at the canthi, with aggravation from damp weather and in the morning.

Calcarea phosphorica and iodidum.—Are serviceable in strumous cases presenting enlargement of the tonsils and cervical glands, with the eye symptoms of the carbonate.

Hepar sulphur.—The lid margins are studded with small ulcers which destroy the lid tissue, or they are thick, inflamed, and tender to touch, with small furunculous swellings along the margins or in the meibomian glands; eczematous condition of the face or outer canthus of the lid, with cracking and bleeding on opening the eyes.

Petroleum.—Indicated in affections of the lid when there is itching and dryness with smarting and sticking pains in the inner canthus. The skin of the lid is

often rough and dry, and frequently accompanied by the occipital headache characteristic of Petroleum. The external application of vaseline or cosmoline softens the skin and prevents the rapid formation of crusts and the gluing together of the lids, and thus by giving relief from this annoyance exerts a beneficial influence.

Antimonium crudum — The lids are inflamed, swollen, moist, and there is a pustular eruption upon the lids or upon the face, with frequent agglutination and photophobia in the morning.

Natrum muriaticum.—Useful where the lids are inflamed and thickened, accompanied by smarting and burning, with some conjunctival inflammation and a sensation as of sand in the eyes. The lachrymation is acrid and excoriates the lids and cheek, giving them a glossy appearance.

Rhus tox.—Suitable in some cases where there is heaviness and stiffness of the lids, or an edematous condition with profuse lachrymation.

Sepia—Scaly conditions of the lids, or small points of pustular inflammation at the roots of the cilia, with a sensation as if the lids pressed too hard on the eyeball.

Staphisagria.—Lids with dry, uneven margins or hard nodules, and much itching and sensation of dryness of the eyes in the morning.

Argentum nit., Euphrasia, Antimonium tart., and Mercurius nit. may be indicated in cases dependent upon or associated with conjunctival disease. Other remedies may relieve when indicated by the general

symptoms of the remedy without special reference to the eye symptoms.

What is trichiasis?

An inversion of one or more eyelashes, a frequent result of prolonged inflammation of the conjunctiva and lid margins. The incurved cilia give rise to persistent conjunctivitis, haziness or vascularity of the cornea.

What is distichiasis?

A congenital separation of the double row of eyelashes with the inversion of the inner row.

What is the treatment?

Removal of the inverted cilia by extraction with cilia forceps. Electrolysis of the hair bulb, when skillfully done, offers a successful method of treatment. Transplantation of the outer portion of the lid or cutting out the follicles of the lashes at the border of the lid may be required.

What is entropion?

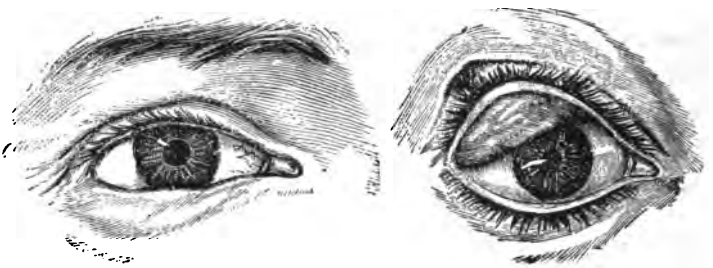
Partial or complete inversion of the margins of the eyelids against the eyeball.

What is spasmodic entropion?

A form of entropion due to spasm of the orbicularis muscle; senile entropion occurring in old people with lax and wrinkled skin, and it sometimes follows bandaging the eyes after cataract operation. The lower lid is generally affected; the ciliary margin is rolled inward, causing an irritation of the cornea and conjunctiva.

What is the treatment of the spasmodic form?

When due to bandaging, the removal of the cause, painting the lid with collodion, or applying strips of plaster to the affected lid until the fibres of the orbicularis recover from the spasmodic condition. If from



Entropion. Ectropion.

other causes, benefit will result from the constant effort of the patient to keep the cilia in proper position by drawing upon the skin of the lids. In some cases excision of an elliptical portion of the skin of the lid may be sufficient to relieve the condition.

What are the causes of entropion?

In addition to those mentioned as causing the spasmodic form, is contraction of the conjunctiva after trachoma or granular conjunctivitis. The cicatrices formed in the conjunctival tissue as the result of trachoma, contract and increase the curvature of the tarsus, the ciliary margin of the affected lid being turned inward.

Of what does the treatment consist?

Either in removing the cilia, together with their bulbs, so as to relieve the irritation of the cornea, or an

operation for the relief of the entropion by the removal of a portion of the tarsus, with or without the removal of a bit of the overlying skin of the lid. A careful study of the condition of the lid is necessary before deciding upon the adoption of one of the various entropion operations which have been devised.

What is ectropion?

An eversion of one or both lids, the lower one being more frequently affected. As a result of the turning out of the lid, its conjunctival surface is exposed to the air and other sources of irritation and becomes inflamed, thickened, and often the seat of granulations; the cornea and eyeball suffer from the loss of their natural covering, and if the lower lid is the one affected the tears overflow upon the face.

What are the causes of ectropion?

Thickening of the conjunctiva from chronic and purulent inflammations, contraction of the skin or tarsus of the lids from burns, wounds, cancerous growths, or caries and necrosis of the orbital margin. Paralysis of the seventh or facial nerve also produces it.

What is the treatment of ectropion?

When due to thickening of the lid, dependent upon inflammation of the lid edge or of the conjunctiva, the effort is to be made to reduce the thickened lid or conjunctiva by treatment directly applicable to such conditions. If paralysis of the facial nerve is the cause, the restoration of the function of the nerve must be accomplished. When due to the contraction incident to burns or destruction of portions of the lid, some

well selected surgical operation is indicated, usually a flap operation, or one which involves the transplantation of a portion of skin after the removal of the cicatrix by dissection. When the cicatrix is small, the effect of the contracting tissue may be relieved by massage over the part or division of the cicatricial bands.

What are the operations of canthotomy and canthoplasty?

Canthotomy, or division of the outer canthus, is an operation devised for the purpose of relieving the pressure upon the eyeball in case of great swelling of the lids from acute or chronic inflammation. Canthoplasty includes not only the division of the outer canthus, but also the introduction of a portion of transplanted skin, which, when properly adjusted, results in a permanent enlargement of the palpebral fissure. The latter operation may be indicated in some cases of entropion.

What is tarsorrhaphy?

An operation intended to diminish the palpebral fissure, a measure necessary in certain cases of ectropion. The margins of the lids at the outer canthus are denuded of their skin and cilia for the portion necessary and the lid edges united by sutures.

What is blepharoplasty?

A plastic operation intended to repair the loss of an eyelid, which has occurred from wounds, ulcerations, or malignant growths. It is performed by the transplantation of a flap of skin of sufficient size to cover the destroyed area of the lid.

What is ptosis?

A condition of the upper lid which occurs when from increased weight of the lid from swelling, inflammation, or tumors in it the power of the levator palpebræ muscle is not sufficient to raise it. When due to these causes it may be partial or complete. The term ptosis, however, is intended to express a paralysis or paresis of the levator muscle of the lid from deficiency in the nerve supply from the motor branch of the third, due to traumatism, or any disease which may affect its function.

How is ptosis to be relieved?

By reducing the swelling or increased weight of the lid by treatment of the diseased lid or the removal of new growths which may have invaded its structure, and when due to the paralysis of the levator muscle by restoring its function. When such measures are inefficient and when it is congenital an operation which will bring the paralyzed lid under the control of the occipito-frontalis muscle by excising an elliptical section of the skin of the lid, together with the underlying portion of orbicularis muscle, is often of benefit. When this fails the operation devised by Pagenstecher, which consists in the formation of cicatricial bands from the margin of the lid to the anterior portion of the frontalis muscle by means of subcutaneous sutures, may succeed.

What is the effect upon the eye in paralysis of the orbicularis muscle?

The condition termed lagophthalmos, in which there is inability to close the eyelids. The lower eyelid falls

away from the eyeball and the tears overflow upon the cheek from the eversion of the punctum and lid. If the paralysis cannot be relieved an improvement of the eversion of the lid may sometimes be secured by tarsorrhaphy.

What is blepharospasm?

A spasmodic contraction of the orbicularis muscle, which may be clonic or tonic, and which results from some corneal or conjunctival irritation or inflammation. Nictitation, or frequent winking, is of the clonic variety, and usually arises from some local irritation of the conjunctiva of the lids or eyeball, due to foreign bodies, hyperemia, inflammation, or anomalies of refraction. The tonic variety or true blepharospasm occurs as a result of diseases of the cornea, hyperesthesia of the retina and hysteria. When arising from these causes treatment is to be directed to the local or general condition which excites it. Such remedies as Agaricus, Conium, Gelsemium, Ignatia, Physostigma, and Phosphorus may, when indicated, give prompt relief.

What is eczema of the lids?

An affection of the skin of the lid, which results from the extension to the lids of an eczema of the face, and is frequently the accompaniment of phlyctenular eruptions of the cornea and conjunctiva. It requires for its cure the use of such remedies as may be indicated by the condition of the eyeball, when involved, or that of the accompanying eczema of the face.

What is sympblepharon?

A union of the conjunctiva of the eyeball with that

of the lids by cicatricial bands which have been developed as the result of burns or traumatism of these tissues, causing a deformity and impeding the movement of the eyeball or eyelids. It requires for its correction a dissection of the cicatricial bands and the transplantation of healthy conjunctiva to cover the wound caused by the dissection.

What is ankyloblepharon?

The union of the lids at their free margins. It may be partial or complete and congenital or acquired. Injuries or burns involving the lid edges may cause it. For its relief an incision is to be made along the line of adhesion.

What is epicanthus?

A congenital condition in which a fold of skin overlaps the inner canthus of one or both eyes. The nose bridge appears very wide. The deformity decreases and commonly disappears with the development of the bones of the face. When epicanthus persists after the age of puberty it can be corrected by an operation consisting in the dissection of an oval piece of skin of proper size from the median line over the root of the nose and the coaptation of the edges of the wound.

What is xanthelasma?

The presence of yellowish patches in the skin of the eyelids, more commonly observed at the inner angle and in women of middle age. The condition is due to a proliferation of certain granular cells from the deep portions of the skin. The patches are painless

and benign, but present more or less deformity, which, if desired, may be removed by excision.

What malignant growths affect the eyelids?

The most frequent is epithelioma, which commonly attacks the skin at the inner angle, just below its free edge, but may occur on any other portion of the eyelid. The removal of all the diseased portion is advisable. Sarcoma may appear in either eyelid, but is a rare affection in children or young adults, and requires complete removal.

What is coloboma of the lids?

A congenital fissure of the lids of the same character as hare-lip.

What is molluscum contagiosum?

An affection of the face and eyelids characterized by the appearance of one or more small, hemispherical tumors, varying in size from that of a pin-head to that of a pea. A slight dimple is seen upon the top. The contents appear albuminous or sebaceous and must be thoroughly removed by incising the tumor at its base and squeezing it with forceps.

What other affections of the lids may be present?

Nævi, warts, moles, chancres, and herpes zoster.

Diseases of the Conjunctiva.

What is the conjunctiva?

It is the delicate mucous membrane lining the lids, continuous with the integument at their margins and reflected over the anterior portion of the globe, forming

the outer protective covering of the cornea and exposed portion of the sclera.

For convenience of description, how is it divided?

Into three portions, the palpebral, the fornix, and ocular. The palpebral portion lines the inner surface of the lids. The fornix is that portion which passes from the lid to the eyeball and consists of transverse folds of the conjunctiva at the upper and lower portions of the eyeball. They are designated as the upper and lower fornix, retro-tarsal fold or cul-de-sac, and shut off the cavity of the orbit from without, but owing to their laxity, do not impede the motion of the eyeball. The ocular portion is that which covers the sclera and which is also continued over the cornea as its epithelial layer. At the inner canthus of each eye, the conjunctiva forms a semilunar fold, the plica semilunaris, upon which is a small elevation called the caruncla lachrymalis or caruncle. The conjunctiva is well supplied with blood-vessels from the muscular and lachrymal branches of the ophthalmic artery and with nerves from the fifth cranial.

What is ecchymosis of the conjunctiva?

An effusion of blood within the conjunctiva from rupture of one or more of its capillaries. The extravasation may be local or general.

What is meant by the term chemosis?

An edematous swelling of the conjunctiva, from infiltration of its structure, which may be passive or inflammatory. The cornea appears as if in a cavity formed by a ring of swollen conjunctiva. The swelling,

when inflammatory, is hard and impedes the circulation of the blood destined to supply the cornea.

What is conjunctival emphysema?

A colorless swelling of the conjunctiva, from distension of the connective tissue spaces with air, which occurs with fracture of the nose and from lachrymal disease. There is crepitation or a slight crackling sensation on pressure. A pressure bandage may be applied if the emphysema is extensive.

What is hyperemia of the conjunctiva?

A condition of circulatory stasis within the capillaries of the conjunctiva which may be acute or chronic.

What are the causes of conjunctival hyperemia?

It is due to exposure of the eyes to the influence of irritating gases, smoke, dust, or bright lights; to wounds, certain errors of refraction or improper use of the eyes.

What are the symptoms of conjunctival hyperemia?

The injection of the blood-vessels, chiefly of the palpebral conjunctiva; with development of papilliform elevations at the edges of the tarsus and in the retrotarsal folds and an increased secretion of tears, with itching, pricking, sandy, dry or hot sensations, especially on close use of the eyes.

In what does the treatment of conjunctival hyperemia consist?

In the removal of the cause, the correction of any refractive errors, the application of a soothing collyrium and the administration of some internal remedy, homeopathic to the condition.

What is conjunctivitis?

Any inflammation of the conjunctiva.

Name the various forms of conjunctivitis.

Catarrhal or simple, purulent, croupous, diphtheritic, trachomatous and phlyctenular.

What determines the variety of inflammation?

The cause, grade of inflammation and character of the discharge.

What is the danger of contagion in conjunctivitis?

All discharges from the eye which contain pus are very likely to produce, when transferred to a healthy eye, an inflammation of the conjunctiva similar in character to the inflammation which caused the discharge, but which may be of greater intensity.

What is catarrhal or simple conjunctivitis?

A catarrhal inflammation of the conjunctiva, characterized by hyperemia, which may be confined to the lid portions or involve the whole extent of the conjunctiva. The papillary layer swells and more or less loss of epithelium occurs.

What are the causes of catarrhal or simple conjunctivitis?

Its causes are very numerous. More frequently it arises from the presence and irritation of foreign bodies, exposure of the eyes to cold, irritating vapors, dust or chemical irritants, vitiated air or sudden atmospheric changes. It is a frequent accompaniment of acute or chronic nasal catarrh, inflammation of the lachrymal sac, strictures of the lachrymal conduits and blepharitis, and also results from eye strain in errors of refraction. It frequently appears during the eruption

in scarlatina, measles and small-pox, and some chronic cases are caused by a lax condition of the orbicularis, which allows the entrance of air between the conjunctival surfaces of the lid and ball, and in other cases it may occur as a result of the alcohol habit. It is not infrequently epidemic in the fall or spring. The continued instillation of atropin or other drugs often occasions it.

What are the symptoms of catarrhal conjunctivitis?

Increased secretion of mucus and tears; later some pus cells appear and the discharge becomes muco-purulent. Small spots of ecchymosed blood in the ocular subconjunctival tissue are very common and characteristic of catarrhal conjunctivitis. The eyes are suffused, an overflow of tears occurs which, if acrid, excoriate the cheeks; the eyelids are stuck together in the morning; the conjunctiva becomes swollen, but remains smooth; in some cases chemosis may be present, and occasionally there is some febrile excitement. A dry, scratchy, sandy feeling in the eyes is complained of, or there is the sensation of a foreign body under the upper lid. There is frequently aggravation from light.

What is the treatment of catarrhal conjunctivitis?

Removal of all hurtful influences, attention being given to the dietary and hygienic conditions, and avoidance of all alcoholic or malt liquors. The remedial treatment consists in the use of some mild collyria, such as the solution of borax, boracic acid, alum, or tannic acid and glycerin, together with the internal use of Aconite, Belladonna, Euphrasia, Hydrastis, Pul-

satilla, Sulphur, Mercurius, Argentum nitricum, or other remedies which may be indicated.

What is chronic catarrhal conjunctivitis?

When simple catarrhal conjunctivitis has persisted for more than a week or two it is apt to become chronic and remain so, unless by proper treatment and medication the parts are restored to their normal condition. Repeated attacks of acute conjunctivitis often result in a chronic affection of the conjunctiva.

What are the symptoms of the chronic form?

The gluing together of the lids in the morning, smarting and a sandy feeling, with discomfort from artificial light, and perhaps an itching or excoriation of the lids, is all that is usually complained of. The conjunctiva shows some thickening of the epithelial layer, swelling of the subconjunctival tissue, with some enlargement of the papillæ.

What is the treatment of chronic catarrhal conjunctivitis?

This consists in the judicious prescription of such remedies as are usually indicated in the acute variety, according to their indications, and, if desired, the topical use of a weak astringent collyrium of borax gr. x, boracic acid gr. v, or sulphate of zinc gr. j ad $fl\frac{3}{3}j$ of rose or camphor water.

What is purulent conjunctivitis?

A blennorrhagic inflammation of the conjunctiva, much more severe and dangerous than the simple or catarrhal form of inflammation. Its principal varieties are ophthalmia neonatorum, gonorrheal, trachomatous, croupous, and diphtheritic conjunctivitis.

What are its characteristic symptoms?

Usually before the third day the eyelids become reddened, slightly swollen, and with a slight flow of tears. On eversion of the lids bright-red transverse lines occupying the middle of the palpebral conjunctiva may be seen, and soon the edges and angles of the lids become red and painful on pressure. The ocular conjunctiva is next to become involved; it appears bright-red and the swelling of the lids increases. The discharge, which at first was almost entirely of tears, now becomes serous and gradually assumes the appearance of turbid whey. The second or suppurative stage is ushered in usually by a marked increase in the swelling of the lids, which may in twenty-four hours prevent their being opened without considerable force. The upper lid usually overlaps the lower one, and is often so stiff that it is difficult or impossible to turn it. Chemosis becomes very marked, the ocular portion sometimes extruding between the lids, and even eversion of the eyelids may occur. The discharge becomes purulent and abundant and the cornea is constantly bathed in the imprisoned pus. Early in the second stage unmistakable signs of pain may be noticed.

What means should be employed for its prevention?

Prophylaxis of opthhalmia neonatorum depends principally upon the prevention of infection during parturition. For this purpose the vagina should be thoroughly cleansed by antiseptic injections and kept so until the birth of the infant. As soon as the child is born the eyelids, while still closed, are to be washed with dilute chlorine water, and a drop of a two per

cent. solution of nitrate of silver put in each eye whenever there is a probability of infection.

What is the treatment of ophthalmia neonatorum?

It consists primarily in diligent cleansing of the eyes with bits of absorbent cotton and the use of chlorine water, or a two per cent. solution of nitrate of silver, the latter once or twice a day. Internally, Argentum nitricum, Pulsatilla, Hepar sulphur, and Mercurius are often useful.

What is gonorrheal ophthalmia?

An acute purulent conjunctivitis of adults, which originates in contagion from gonorrheal virus and in which the copious secretion becomes also exceedingly infectious in its character. The disease develops in a few hours or a few days, depending upon the intensity of the contagion. The symptoms are those of purulent conjunctivitis of its most violent type and the danger of destruction of the eye is proportionately great.

What is the treatment of gonorrheal ophthalmia?

The patient should be confined to the bed, and in the first stage the application of ice-bags or cold compresses are of service. When one eye alone is affected the other must be protected from infection by the watch-glass and plaster. The important considerations of treatment are, the constant removal of the pus as soon as possible after its formation, the frequent cleansing of the conjunctival sac with chlorine water or boracic acid solution, and the daily application to the lids of a two per cent. solution of nitrate of silver by the surgeon. When ulceration of the cornea occurs, the

use of atropin to dilate the pupil is necessary. The remedies usually indicated are Argentum nitricum, Apis mellifica, Hepar sulphur, Mercurius, Nitric acid, Pulsatilla, and Sulphur.

What is croupous conjunctivitis?

In acute purulent conjunctivitis there is often formed upon the conjunctival surface of the eyelids a fibrinous layer, which is separated with more or less difficulty, leaving the conjunctiva denuded and often bleeding, and when this occurs the conjunctivitis is called croupous. In some cases the croupous condition becomes very marked, and thick casts of the lid or sac may be thrown off. The treatment is that of purulent conjunctivitis, and this feature of the disease rapidly disappears with the frequent use of chlorine water in the eye.

What is diphtheritic conjunctivitis?

A form of purulent inflammation of the conjunctiva extremely rare in this country, but more common in Europe. It is similar in nature to diphtheria of the throat or other membranes, and is accompanied by fever and great prostration. A profuse exudation takes place in the conjunctiva of both lid and eyeball, which coagulates and causes necrosis of the tissue. It rapidly destroys the cornea, and hence is extremely productive of blindness. The treatment is that of other forms of purulent conjunctivitis, together with the use of those remedies which may be indicated by the diphtheritic disease.

What is trachoma or trachomatous conjunctivitis?

A form of purulent conjunctivitis which originates from infection and produces a purulent, infectious discharge, very chronic in its course, and characterized by an hypertrophy of the conjunctiva, which presents a roughened or granular appearance. It may appear at any age and be acute or chronic.

What are the symptoms of trachoma?

The disease develops so insidiously that often it attracts little attention. There is more or less sensitiveness to light, some lachrymation, and a sticking together of the lids and constant sensation of discomfort or sandy feeling in the eye. The upper lid is heavy and hangs down so that the eyes are partially closed. After everting the lids the conjunctiva of the lids and fornix are found red, thickened, and granular. There is more or less discharge, muco-purulent or purulent in character, according to the acuteness of the attack.

What is the course of trachoma?

It is exceedingly chronic, the hypertrophy of the conjunctiva gradually increases up to a certain point, when it disappears and is replaced by cicatricial tissue. Even when it is said to be cured the conjunctiva is always atrophic and cicatricial. The disease may persist for months or years, and in addition to its destructive effect upon the conjunctiva the cornea becomes implicated, and from the constant irritation produced by the granulations a condition of pannus occurs in which the cornea, more particularly at the upper part,

shows a development of blood-vessels and connective tissue elements in its structure. Ulcers of the cornea occur either in connection with the pannus or develop at any other portion. Many changes which affect the position of the lids, retard the movement of the eye-balls, or destroy vision, follow as a result of the prolonged course of the disease.

What is the treatment of trachoma?

It consists in the use of such remedies as Aconite, Arsenicum, Aurum, Kali bichromicum, Mercurius solubilis and protoiodidus, Sulphur and Thuja; cures have been made with each of these remedies, but it is impossible to determine the similimum in the majority of cases. Hence we are compelled to resort to the application of such local irritants and astringents as have been found of use in the treatment of trachoma. This consists in the use of the tannic acid and glycerin (fifteen grains to the ounce), sulphate of copper, nitrate of silver (two per cent. solution), or alum, applied to the lids in a careful manner. Incision and expression of the individual granulations are often of benefit. In acute conditions the use of cold by means of the ice-bag is very valuable.

What is phlyctenular conjunctivitis?

An inflammation of the conjunctiva, often described as pustular, scrofulous or strumous conjunctivitis, and which is characterized by the presence of one or more vesicles which form on the sclerotic portion of the conjunctiva or about the margin of the cornea. The contents of the vesicle, at first clear, soon become yellowish,

and from the vesicle there is frequently a triangular mass of enlarged blood-vessels with its apex at the site of the phlyctenule. If the vesicles are numerous, the whole conjunctiva becomes thickened and injected, the lids swollen, and there is an increased secretion of mucus. There is usually not much photophobia or pain unless the eruption invades the cornea. It is common in childhood but may occur later in life.

What are the causes of phlyctenular conjunctivitis?

The disease occurs in subjects who are generally anemic, suffer from want of proper nourishment, or whose surroundings are not hygienic. It appears more frequently between one and fifteen years of age and in those presenting a strumous diathesis, and is a frequent sequela of scarlet fever, measles, whooping cough, typhoid fever and an eczematous condition of the head or face. In the majority of cases there is usually found some defect in assimilation, or a deficiency or an excess of the nitrogenous elements in the diet of the individual.

What is the treatment of phlyctenular conjunctivitis?

As long as there is no extension of the phlyctenules upon the cornea the vesicles break down in a few days and form a superficial ulcer of the conjunctiva which heals in a few days. Single vesicles tend to recur and multiply and the inflammation of the conjunctiva of the ball, and often of the lids, becomes marked. Constitutional treatment is of the utmost importance in this disease and requires both the internal administration of remedies and the correction of defects of diet and

the improvement of the hygienic conditions. The local application of a mild antiseptic collyrium and the use of some slight astringent as the ointment of the yellow oxide of mercury are of undoubted benefit in many cases.

What remedies are more often indicated in phlyctenular conjunctivitis?

Antimonium crudum.—Pustules on the cornea or conjunctiva, especially in children who are afflicted with pustules on the face and moist eruptions behind the ears. The lids are red, swollen and excoriated by the profuse mucous discharges and lachrymation.

Apis mellifica.—Pustular keratitis, with edema of the conjunctiva and lids. The puffy condition of the conjunctiva and lids is very indicative of the remedy, especially when accompanied by burning, stinging, or shooting pains in the eyes.

Arsenicum.—Cases occurring in thin, ill-nourished children, without marked inflammatory symptoms. There is usually intense photophobia, and profuse, acrid lachrymation. The phlyctenules tend to form ulcers which extend superficially and take on an indolent character.

Aurum muriaticum.—In scrofulous subjects, with ulceration and vascularity of the cornea. Photophobia severe, lachrymation profuse and scalding; eyes sensitive to the touch. The pains are from without inward, and worse upon pressure. The cervical glands are usually swollen; and the patient very irritable.

Baryta.—Both the carbonate and iodide have been

employed in scrofulous ophthalmia, especially when there are enlarged cervical glands.

Calcarea carbonica. — Phlyctenules appearing in fat and unhealthy children, who present a pale flabby skin and enlarged glands. The photophobia is often excessive, and the lachrymation very great and often acrid. The redness and pain are variable and the lids perhaps swollen and glued together in the morning.

Calcarea sulphurica. — This remedy will prove exceedingly valuable in many cases where the general symptoms of Calcarea are present with enlargement of the cervical glands.

Calendula.—Pustular conjunctivitis, with great redness but no photophobia.

Cannabis Indica.—Large pustules on the conjunctiva, with great vascularity.

Chamomilla.—Indicated when occurring in cross, peevish children during dentition, and will often relieve the severity of the symptoms, even though it does not complete the cure. The cornea is usually invaded, and there is great intolerance of light, considerable redness and lachrymation.

Cinnabaris.—The cornea is generally implicated in the trouble, and the symptoms of photophobia, lachrymation, etc., are severe. Pain from the inner canthus across the eyebrows, or extending around the eye is a very marked indication for Cinnabaris.

Conium maculatum. — When the inflammation is chiefly confined to the cornea and there is intense photophobia and profuse lachrymation upon any attempt

to open the spasmodically closed lids. The pains are various, but are generally worse at night. With all this intense photophobia, there is very slight or no redness of the conjunctiva, at least not sufficient to account for the severity of the symptoms.

Croton tiglium.—Phlyctenular keratitis and conjunctivitis, associated with a vesicular eruption on the face and lids; the eyes and face feel hot and burning, especially at night; the photophobia is marked; ciliary injection as in iritis is often present, and considerable pain in and around the eye, usually worse at night.

Euphrasia.—Phlyctenular inflammation, in which the lachrymation is excessive, acrid and burning, or if there is a profuse, thick, acrid, muco-purulent discharge, which excoriates the lids, making them red, inflamed and sore. Blurring of the eyes, relieved by winking, dependent upon the secretions temporarily covering the cornea, especially indicates Euphrasia.

Graphites.—Is one of the most valuable remedies we have for all forms of phlyctenular inflammation. It is useful in both the acute and chronic forms, particularly where there is a marked tendency toward recurrence. It is specially indicated in scrofulous cases, or with exanthematous eruptions about the head or behind the ears, particularly where the eruptions are glutinous, fissured, and bleed easily. Photophobia is usually very marked and lachrymation profuse. There is generally a great aggravation from sunlight, and in the morning, so that often the child cannot open the eyes before nine or ten o'clock. The conjunctiva is usually very red, and the discharges are muco-purulent or thin and exco-

riating. There is often an acrid discharge from the nose accompanying the eye affection.

Hepar sulphur.—Is very useful in the phlyctenular inflammation occurring after measles, or in strumous children, where there is intense photophobia, lachrymation and an injection of the conjunctiva, with swelling of the lids and sensitiveness of the eye to touch, and when the external canthus bleeds on opening them.

Ipecacuanha.—Is one of the most frequently indicated remedies in pustules and phlyctenular ulcers of the cornea and conjunctiva. There is much photophobia; the redness and pain are variable, and nausea may be present.

Kali bichromicum.—Is indicated in phlyctenules of the conjunctiva or in chronic cases with a low grade of inflammation. The chief characteristics are absence of photophobia and of redness, or much less of each than would be expected from the eruption. The eye is often sensitive to the touch, and its secretions are of a stringy character.

Mercurius solubilis.—A valuable remedy in many cases of phlyctenular inflammation in strumous or syphilitic children. There is usually marked redness of the conjunctiva and intense photophobia, so that all light must be excluded, and the discharge is usually thin and acrid. The pains are severe and neuralgic in character, affecting the temporal side of the head and face. They are variously described as burning, sharp, tearing and lancinating, and aggravated in the evening and from exposure of the eyes to artificial light, and

by heat and damp weather, while there is temporary relief from application of cold water to the eyes.

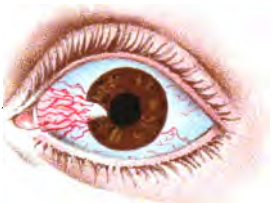
Mercurius corrosivus.—Indicated in the aggravated form of inflammation occurring in scrofulous children. The symptoms are more intense than in the other forms of Mercurius, the pains, photophobia, lachrymation, all being aggravated; the nostrils are often excoriated by the acrid discharge from the eye passing down into the nose.

Mercurius nitrosus.—This remedy is often useful in phlyctenular inflammation of the conjunctiva, and may also be used with good result as a local application in a solution of twenty grains of the first decimal trituration of the drug dissolved in water, a drop or two of the lotion being instilled into the conjunctival sac two or three times a day.

Pulsatilla.—The phlyctenules are more frequently small, but often numerous; the photophobia and pain are commonly slight and the redness variable. The lachrymation and discharge is moderate and bland, although it is not contraindicated if the secretions are profuse. Particularly suitable to the blond women and children.

Rhus toxicodendron.—When there is excessive photophobia, lachrymation and spasmodic closure of the lids. There is generally a vesicular or pustular eruption upon the eyelids or face.

Sulphur.—Very frequently indicated in cases occurring in scrofulous children. Its sphere of action is very wide and suits a great variety of cases of pustulous inflammation of the conjunctiva, and is particularly



Pterygium.

Pannus.

Interstitial Keratitis.

Vascular ulcer of the Cornea.

indicated when there are sharp, darting, lancinating pains, or as if pins and needles were sticking in the eye during the day, or when the pains are aggravated after midnight. There may also be itching, often a thickened condition of the lid and much rubbing of the eyes. The photophobia is variable and may be quite marked in the morning. The lachrymation is usually profuse and the lids generally stick together on awaking. There is often an eczematous condition of the lids, face and head, and a general aggravation from the application of cold water or from bathing the eyes.

What is pterygium?

A triangular fold of thickened ocular conjunctiva with its apex on the cornea and its base toward the canthus. It more often appears at the inner canthus, more rarely at outer canthus, and occasionally at the upper or lower part of the cornea in the direction of one of the recti muscles. Its growth may remain stationary for a long time, but when irritated or inflamed it tends to advance farther towards the center of the pupil and in time destroy the vision.

What is the treatment of pterygium?

Pterygium should be removed as soon as it begins to encroach upon the cornea. The operation may be made by dissection of the conjunctival fold from the cornea and sclera and its excision. Several other surgical methods of treatment for pterygium have been devised and are used.

What is pinguecula?

A small, yellowish elevation often seen upon the

ocular conjunctiva between the caruncle and margin of the cornea. It consists of changed subconjunctival tissue and is harmless. If it becomes a source of disfigurement or if inflamed, it may be cut off with the scissors.

What is granuloma of the conjunctiva?

A polypus of the conjunctiva arising from disease or injury, and may be pedunculated or have a broad base. It is readily removed by clipping it off.

What malignant tumors are found in the conjunctiva?

Epithelioma and sarcoma. The former usually begins near the margin of the cornea and advances on the cornea which it soon involves. Sarcomata are generally pigmented and grow in about the same manner as epitheliomata.

Diseases of the Cornea.

What is the structure of the cornea?

The cornea, which forms the anterior one-sixth of the external coat of the eyeball, is a perfectly transparent, highly polished membrane, and having a shorter radius, projects somewhat from the sclera and admits light to the interior of the eye. It is ellipsoidal in shape, its horizontal diameter being longer than the vertical, owing to the overlapping of the sclera, of which it is modified continuation. It consists of five layers, an outer layer of epithelium continuous with the conjunctiva, a thin structureless membrane known as that of Bowman, a thicker central layer or true corneal tissue, a posterior elastic membrane, that of Decemet,

and upon the latter, a layer of endothelium. The cornea has no blood-vessels except at its margin and is nourished by endosmosis from these capillary vessels and through a system of lymph canals. Its abundant nerve supply is derived from the ciliary nerves.

What is characteristic of the affections of the cornea?

The photophobia or intoleration of light, and the ciliary injection, a vascular congestion of the sclera which encircles the periphery of the cornea.

What are the principal inflammatory diseases of the cornea?

Superficial, phlyctenular, circumscribed and interstitial keratitis.

What is keratitis phlyctenularis?

A form of corneal inflammation more frequent during childhood, characterized by the occurrence on the cornea of papules, vesicles or pustules, similar to those which characterize phlyctenular conjunctivitis, it being often an extension of that disease. These phlyctenules may be single or multiple, often numerous enough to encircle the periphery of the cornea. There is always a bundle of minute vessels in the scleral conjunctiva which extends to the vesicle, and when a leash of vessels is developed in the cornea, the term *fascicular* keratitis has been applied to it.

What are the causes of keratitis phlyctenularis?

The disease occurs in subjects who suffer from want of proper nourishment or from malnutrition. It is a common affection of strumous children and a frequent sequela of measles, scarlet fever, whooping-cough and typhoid fever.

What are the symptoms of keratitis phlyctenularis?

There is intense photophobia and often much pain. The eyelids are opened with difficulty. One or more small points of ulceration are found upon the cornea, or the latter may be vascular and the eyeball injected. In advanced cases the conjunctiva becomes thickened and shows considerable muco-purulent discharge. The mature vesicles contain pus, which break down and ulceration results. The phlyctenules may occur in succession and may spread until the greater part of the cornea becomes involved.

In what does the treatment consist?

This consists in improving the general nutrition of the patient by the use of a digestible and nutritious diet and hygienic improvement of the surroundings; the protection of the eyes from light by dark glasses, and the careful selection of a homeopathic remedy. The local use of atropin and cocain are often necessary and beneficial.

What are the indications for the use of the more important remedies in this affection?

Arsenicum.—Cases occurring in thin, ill-nourished children, without marked inflammatory symptoms. There is usually intense photophobia, and profuse, acrid lachrymation. The phlyctenules tend to form ulcers which extend superficially and take on an indolent character.

Calcarea carbonica.—Phlyctenules occurring in fat, unhealthy children, with pale, flabby skin and enlarged glands. The photophobia is often excessive, and the lachrymation very great and often acrid. The

redness and pains (sticking in character) are variable, and the lids perhaps swollen and glued together in the morning.

Calcarea sulphurica.—Will prove exceedingly valuable in many cases, when the general symptoms of Calcarea are present with enlargement of the cervical glands. The lower attenuations should be used.

Graphites.—This is one of the most valuable remedies we have for all forms of phlyctennlar inflammation. It is useful in both the acute and chronic forms, particularly in cases where there is a marked tendency to a recurrence. It is specially indicated in scrofulous cases, or with eczematous eruptions about the head or behind the ears, particularly when fissured and bleed easily or have a glutinuos discharge. The photophobia is usually very marked, and the lachrymation profuse, although in some cases nearly or entirely absent. There is generally a greater aggravation from sunlight than from gaslight and in the morning, so that often the child cannot open the eyes before nine or ten o'clock. The conjunctiva is frequently very red, and the discharges are muco-purulent, constant, thin and excoriating. The pains are variable and not characteristic, the lids are sore, red and agglutinated in the morning, or else covered with dry crusts, while the external canthi are fissured and bleed easily upon opening the eye. There may also be an acrid discharge from the nose accompanying the eye affection.

Hepar sulphur.—Is adapted to phlyctenular inflammation occurring after measles, or in strumous children, where there is intense photophobia, lachrymation, an

injection of the conjunctiva with swelling of the lids, sensitiveness to touch and a desire to have them covered, and when the external canthi bleed easily on opening them.

Mercurius corrosivus.—Indicated in the aggravated form of inflammation occurring in scrofulous children. The symptoms are much more marked than in the other preparations of mercury; the pains, photophobia, lachrymation, all being aggravated; the nostrils are often excoriated by the acrid discharge from the eye passing down the nose.

Mercurius dulcis.—Although calomel is used very extensively by the old school in scrofulous ophthalmia, it is but rarely applicable to phlyctenular inflammation; some cases, occurring in pale, flabby subjects, with excoriation of the nose and swelling of the upper lip, have been benefited.

Mercurius solubilis.—A valuable remedy in many cases of phlyctenular inflammation in strumous and syphilitic children. There is usually marked redness of the conjunctiva, and violent photophobia, so that all light must be excluded, and the discharge is usually thin and acrid. The pains are severe and neuralgic in character, affecting the temporal side of the head and face. They are variously described as burning, sharp, tearing and lancinating, and aggravated in the evening and from the exposure of the eyes to artificial light, by heat and in damp weather, while there is a temporary relief from the application of cold water to the eyes. The lids are often thick and swollen and spasmodically closed and excoriated by the discharge.

Mercurius nitrosus.—This remedy, seems to suit severe as well as mild affections, acute or chronic, with or without much photophobia, and in some cases preventing severe pain; in others, pain is absent. It may be used both internally and externally. If externally, ten grains of the first decimal trituration is to be dissolved in two drachms of water and applied by means of a camel's-hair brush to the phlyctenule two or three times a day.

Pulsatilla.—The phlyctenules are more frequently of the small variety, but often numerous; the photophobia or pain is commonly slight and the redness variable. The lachrymation and discharge is moderate and bland, although this remedy is not contra-indicated if the secretions are profuse. Particularly suitable to the blond women and children upon whom Pulsatilla seems to have so good an action.

Rhus toxicodendron. — Where there is excessive photophobia, lachrymation, and spasmodic closure of the lids. There is generally a vesicular or pustular eruption upon the eyelids or face.

Sulphur.—Very frequently indicated in cases occurring in scrofulous children. Its sphere of action is very wide and suits a great variety of cases of pustular inflammation of the conjunctiva, and is particularly indicated when there are sharp, darting, lancinating pains, or as if pins and needles were sticking in the eye during the day, or if the pains are worse during the night. There may also be itching, often a thickened condition of the lid and much rubbing of the eyes. The photophobia is variable and may be quite marked

in the morning. The lachrymation is usually profuse and the lids are generally agglutinated in the morning.

Antimonium tartaricum, Ipecac, Kali bichromicum, Mezereum, Croton tiglium, Euphrasia, Sepia and Baryta are also serviceable in phlyctenular keratitis, and will give prompt results when indicated.

What are ulcers of the cornea?

A form of ulcerative inflammation of the cornea characterized by softening and molecular death of a portion of the cornea from accumulation of infiltrated cells, and which may be of a sthenic or asthenic type. The ulcers present usually a grayish base with swollen edges and may be superficial or deep.

What are the dangers in ulcerations of the cornea?

Changes in the transparency or opacities of the cornea and perforation of the cornea, with inflammatory involvement of the iris and the deeper tissues of the globe.

What are the symptoms of ulceration of the cornea?

In the sthenic form, the chief symptoms are photophobia, congestion, pain, ciliary injection and lachrymation. In the asthenic form there is little or no pain, photophobia, lachrymation, or vascularity. The photophobia is more severe in superficial than deep ulceration. The pain is variable and commonly referred to the parts around the eye. The ulcers are found in many varieties, as regards their size, form, location, vascularity and color, but are classified into three groups, superficial, deep, and serpiginous, the latter occurring more frequently in elderly people and having a chronic course.

What are the principal complications of ulcers of the cornea?

Perforation of the cornea, prolapse of the iris, cataract, corneal fistula and hypopyon, a collection of pus in the anterior chamber.

What is the treatment of ulcers of the cornea?

This consists in the removal of any source of irritation, such as foreign bodies, inverted eyelashes, catarrhal, granular, or purulent ophthalmia, and in protecting the ulcer from friction against the eyelids and from exposure to light. Remedies which stimulate the ulceration, sooth the local pain or improve the general health must be selected by a comparison with the local as well as the general symptoms of the diseased conditions, the symptomatic indications governing the choice of the remedy. Atropin solution, with or without the admixture of cocain, when used locally tends to diminish the pain and hasten the recovery. Hot applications or fomentations are of benefit in many cases.

What are the indications for the principal remedies in ulcers of the cornea?

Aconite.—Superficial ulcers arising from injuries. It may be used both internally and externally.

Arsenicum.—Corneal ulcers occurring in weak, anemic children. They are often superficial and have a tendency to recur. The photophobia is excessive and the lachrymation acrid and burning. The pains are more frequently burning and aggravated after midnight. Small grayish central ulcers, which occur in young children and tend to perforate.

Aurum.—Vascular ulceration of the cornea and ulcerations occurring during the course of pannus, or as the result of abscess. There is much photophobia, profuse scalding lachrymation and sensitiveness of the eye to touch, and pains apparently extending from the parts around the eye to the eyeball, and aggravated by touch.

Calcarea carbonica and calcarea phosphorica.—Ulcerations occurring in ill-nourished patients which show a tendency to slough, or which result from abscess.

Conium.—Superficial ulcers without much pain or redness, but with intense photophobia.

Graphites.—In some cases of ulceration of the cornea which have followed attacks of phlyctenular inflammation of the cornea or conjunctiva.

Hepar sulphur.—A valuable remedy for all ulcers or abscesses when there is pus in the anterior chamber. There is usually a marked sloughing tendency, with throbbing pain and intense photophobia, while the conjunctiva is often red and thickened or chemotic. There is great sensitiveness of the eye to touch, but relief from the application of warm compresses.

Ignatia.—Small, transparent ulcers, without much discomfort, occurring in connection with derangements of digestion; also small pinhole ulcers, which are attended by photophobia and sensation as of something in the eye.

Mercurius.—Often indicated in both superficial and deep ulcerations. There is generally grayish infiltration of the base and around the ulcer, which is also

often vascular. The discharges from the eye are profuse, thin and excoriating. There is a general aggravation at night. Concomitant symptoms more frequently decide upon the particular form of mercury to be administered; the eye symptoms indicating Mercurius corrosivus being more intense and there is much ciliary injection and pain.

Mercurius nitrosus—More useful in those ulcerations which partake of a phlyctenular character.

Mercurius protoididus. — Ulcerations occurring with pannus.

Silicea. — Indicated in some cases of sloughing ulcers of the cornea, as in marginal ulcers, and when small, funnel-shaped, non-vascular ulcers appear near the center of the cornea and rapidly perforate it.

Sulphur.—When the ulceration is indolent and tends to slough, this remedy may be useful. There is often considerable infiltration around the ulcer, but no vascularity. The photophobia, lachrymation and other symptoms are variable. The sharp, sticking pains which are commonly present, and worse after midnight, are very characteristic. The subjects are strumous and the general condition is indicative of Sulphur. Many other remedies may have to be consulted for individual cases.

What is interstitial keratitis?

An inflammation of the substance of the cornea, and which is essentially a disease of childhood, occurring commonly between the ages of five and twelve years, and very rarely in adult life.

What are the synonyms of interstitial keratitis?

Diffuse, syphilitic, parenchymatous, strumous and scrofulous keratitis.

What are the causes of interstitial keratitis?

Inherited syphilis is the undoubted cause of the disease, and in children in which it presents itself, the physiognomy, notched teeth, and affections of the skin, mouth and bones so indicative of inherited syphilis are to be found.

What are the symptoms of interstitial keratitis?

A grayish opacity, beginning in the center of the corneal tissue, gradually extending and increasing in density until the whole cornea loses its transparency. Sometimes the opacity begins at the margin in one or more spots and extends to the center. In the preliminary stage the scleral ring of injection and increased lachrymation may be noticed. The sight is rapidly lost, the corneas usually being affected symmetrically or successively, and in young children frequent falls result from the imperfect vision. In from two to four weeks the cornea becomes so opaque that the iris and pupil are no longer seen, and the grayish-white appearance of the cornea is like that of ground or frosted glass, the surface of the cornea, being roughened from the loss of portions of its epithelium, or it may present a reddish color due to vascularity.

What complications may occur in interstitial keratitis?

An inflammation of the iris often complicates the attack with adhesions to the lens capsule, or occlu-

sion of the pupil, which lessens the chances of recovery of vision and increases the discomfort of the patient.

What is the prognosis in interstitial keratitis?

As regards vision it is good, but the cornea rarely recovers its perfect transparency. The duration of the attack is prolonged from six months to two years. Relapses are frequent, and complications of the iris, choroid and retina, or glaucoma, may occur, rendering the prognosis more grave.

What is the treatment of interstitial keratitis?

No local applications, except that of atropin in cases of iritic complications, or the use of cocain for anesthetic purposes, are advisable, as all others are harmful. In rare cases hot compresses may be of value, but should be applied under skillful direction. Particular attention must be given to proper feeding or necessary stimulation. Homeopathic remedies have the power, when properly used, to lessen not only the severity of the attack and mitigate its symptoms, but also to shorten its duration in a remarkable manner.

What are the indications for the most frequently indicated remedies in interstitial keratitis?

Aurum muriaticum. — This remedy is one of the most frequently indicated in cases of syphilitic keratitis. The symptoms are those of diffuse infiltration with moderate photophobia, and pain of a dull character referred to the parts about the eye.

Mercurius solubilis. — The inflammation is more active than that of Aurum; and there is usually more pain, greater ciliary injection and nocturnal aggravation.

Arsenicum.—Central diffuse keratitis with marginal vascularity. The photophobia is intense, the lachrymation profuse, and burning pains are complained of. The aggravation after midnight, restlessness and thirst are commonly present.

Apis mellifica.—With the infiltration of the cornea there is moderate injection of the ciliary region and photophobia, Febrile disturbance, thirst and drowsiness often accompany the eye affection.

Hepar sulphur.—Often serviceable when there is much ciliary injection or pain, great photophobia, lachrymation, and sensitiveness of the eye to touch.

Baryta iodidum.—When enlargement of the cervical glands, which are hard and painful on pressure, accompanies the corneal inflammation.

Kali muriaticum.—Interstitial keratitis with or without pain, moderate photophobia and redness, more often indicated in the later stages of corneal inflammation and aids in the absorption of its inflammatory exudation.

What is abscess of the cornea?

Abscess of the cornea or suppurative keratitis is a form of corneal inflammation attended with suppuration, and may be diffuse or circumscribed and is not infrequently a complication or extension of some other local affection, as purulent conjunctivitis, or appears with traumatic iritis and irido-cyclitis after the extraction of cataract. When circumscribed it may appear spontaneously in persons of scrofulous diathesis or from injury to the cornea, as from a foreign body under the eyelid or an abrasion near the center of the cornea. In

the diffuse form the cornea first loses its brilliancy, then assumes a grayish white appearance which soon becomes of a yellow tint, indicating the formation of pus between the lamellæ. The process of infiltration and suppuration occurs very rapidly and from loss of substance the cornea becomes unable to resist the intra-ocular pressure, and ruptures, forming extensive perforation; or a bulging forward of the anterior part of the globe may occur, producing anterior staphyloma. Abscess of the cornea occurs sometimes near the surface, breaks down and forms a superficial ulcer, or if more deeply situated, the pointing takes place inward and discharges pus into the anterior chamber, and sometimes a fistula of the cornea results. The laminæ, between which the pus is situated, are sometimes so separated that the latter gravitates toward the inferior part and so presents a resemblance to the lanule of the base of the finger nail; hence the condition has been termed onyx. When puro-lymph is present in the anterior chamber it gravitates toward the lower part and the condition is then termed hypopyon. Either condition may be present or they may coexist in the same eye.

What is the treatment of abscess of the cornea?

In the early stages, hot fomentations to the eyelids, and the instillation of a one-half per cent. solution of atropin into the palpebral aperture at frequent intervals until the abscess is established, when it may be treated by puncture or by the incision of Saemisch. When hypopyon exists, paracentesis of the anterior chamber may be performed. Small collections of puro-

lymph are, however, frequently absorbed from the anterior chamber. The general health of the patient should be sustained by good food and fresh air.

What remedies are usually indicated in abscess of the cornea.

The remedies useful in this form of corneal trouble are Hepar sulphur, Calcarea carbonica, Calcarea hypophosphite, Mercurius solubilus, Silicea and Sulphur, according to the indications given.

Hepar sulphur.—Abscess and sloughing, or sloughing ulcers, of the cornea, when accompanied by hypopyon. Photophobia intense, lachrymation profuse, and there is great redness of the cornea and conjunctiva, with severe aching, throbbing pains, relief from warm applications, and aggravation from cold. There is marked sensitiveness of the eye to touch.

Calcarea carbonica.—Cases occurring in children with the concomitant indications of Calcarea. The pains, redness and photophobia are variable.

Calcarea hypophosphorica.—In weak, debilitated individuals where there is great purulent infiltration and tendency to sloughing.

Calcarea sulphuris.—Very useful in many cases of purulent infiltration of the cornea occurring in debilitated subjects.

Mercurius solubilis.—In abscess of the cornea when there is a grayish infiltration extending some distance beyond the abscess. The conjunctival redness and photophobia are marked, while the lachrymation may be profuse and acrid. There is aggravation of the

condition at night and from either very cold or very warm applications.

Silicea.—Abscess of the cornea with hypopyon. The pain, photophobia and redness are not characteristic. There is, generally, relief from wrapping the head or bandaging the eye.

Sulphur.—Not infrequently indicated in suppurative inflammation of the cornea in strumous constitutions. The sharp sticking pains of the eyeball, which occur more often after midnight, are very characteristic.

What is keratitis bullosa?

A form of keratitis characterized by an elevation of the epithelium and possibly of the corneal layers, from an effusion of a slightly cloudy fluid. The elevation is of considerable size and of a sacciform appearance. Its approach is accompanied by severe periorbital neuralgia, photophobia and acute congestion of the eye. After rupture of the bulla, the pain ceases, but a more or less deep ulceration marks the location of the bulla. There is a tendency to recurrence of the attacks.

What treatment is advised for keratitis bullosa?

To relieve the pain, remove the envelope of the bullæ and then treat as an ordinary ulcer.

What is keratitis postica or punctata?

Keratitis postica is an inflammation of the deep layers of the cornea produced as by inflammation of the choroid, ciliary body and iris, and is characterized by a precipitate of opaque dots generally arranged in

a triangular manner with apex upward upon the posterior elastic lamina of the cornea. The overlying cornea is hazy, its surface at times slightly uneven. In some cases isolated whitish spots surrounded by a cloudy area, appear in the parenchyma of the cornea, followed later by inflammatory evidences and development of iritis.

What are the symptoms of keratitis postica?

Pain, photophobia, lachrymation, ciliary injection and hypersecretion of aqueous humor. The posterior surface of the cornea presents more or less small grayish or dirty white points, which may extend into the parenchyma and result in sclerosis of that tissue. Its course is long lasting and obstinate, with great tendency to recurrence and periodical aggravations.

What are the causes of keratitis postica?

More frequent in women, and is often ascribed to some constitutional dyscrasia, as syphilis or scrofula, and is often associated with serous iritis or inflammation of the uveal tract.

Of what does the treatment consist?

In a good wholesome nourishing diet, exercise in the open air and the use of the homeopathically indicated remedy, which is often found to be Kali bichromicum. Gelsemium, Aurum, Calcarea, Arsenicum, Hepar or Mercurius may also be indicated.

What are the results of inflammation of the cornea?

Corneal opacity, staphyloma and fistula.

Describe corneal opacities.

According to the density of the scar they are termed

leucoma, macula and nebula; the former being the most dense. Vision depends upon their location and density as regards the pupil. When the opacities are central they may give rise to nystagmus, an oscillating, restless movement of the eyes due to the imperfect sense of accommodation. In cases where the opacity is bilateral, divergent squint occurs, and when unilateral it may cause a convergent squint.

What is the treatment of corneal opacities?

The use of such remedies as will hasten or promote absorption of the opaque elements, such as Hepar sulphur, Calcarea carbonica, Silicea and Sulphur. In addition, certain drugs, when applied to the scar, occasion a temporary congestion and mild inflammation and thereby hasten its clearance; such as mercurius nitrate, boracic acid powder, sulphate of soda or resorcin, when applied by means of a cotton swab. An iridectomy, to form a new pupil, is necessary in some cases. For cosmetic purposes, the leucoma is sometimes tattooed with india ink.

What is staphyloma of the cornea?

A bulging projection of the cornea, resulting from either perforation of the cornea and prolapse of the iris following ulceration in purulent forms of conjunctivitis, or from the softening of the corneal tissue which accompanies some cases of chronic phlyctenular inflammations with increased fluid pressure within the eye. If the bulging involves the whole cornea, it is apt to continue until it becomes a serious deformity and protrudes between the lids, notwithstanding the efforts to lessen

the tension by frequent tappings of the anterior chamber (paracentesis corneæ) or by the removal of a portion of the iris (iridectomy). When it is complete and subjected to irritation, inflammation of the ball occurs and it becomes necessary to remove either the projecting portion (abscission) or the whole eyeball (enucleation).

What is fistula of the cornea?

A fistula of the cornea is an orifice remaining after a wound, or more commonly because of the failure of an ulcer to heal, through which the aqueous humor constantly drains away and the eye is kept irritated. When pressure is made upon the globe, a drop of the aqueous may be seen oozing through the fistula. The depth of the anterior chamber is diminished and the iris is drawn forward toward the opening. It may last for a long period and stubbornly resist efforts at cure.

What is the treatment of corneal fistula?

The treatment comprises the use of atropin, touching the fistula with nitrate of silver, and bruising its edges with fine forceps to excite healing, compress bandage, iridectomy and so forth. When the eye is a sightless and staphylomatous one, or the condition is such as to excite sympathetic irritation of the fellow eye, it should be removed without hesitation or delay.

What is anterior synechia?

A union or adhesion of the iris to the posterior surface of the cornea.

Diseases of the Sclera.

What is the sclera and its anatomy?

The sclera or sclerotic coat of the eye is a strong, opaque, unyielding, dense fibrous structure, its outer surface white and smooth, except where the tendons of the ocular muscles are inserted, and is thickest at the posterior portion, where the sheaths of the optic nerve unite with it. The optic nerve pierces the sclera about one-tenth of an inch to the inner side of the axis of the eyeball. The sclera consists of connective tissue fibres and fine elastic tissue, which interlace and form a dense meshwork. A few capillary blood-vessels with wide meshes ramify through its texture. At its anterior border and inner surface is the circular canal of Schlemm, giving passage to various plexuses of vessels from the sclera, and the ciliary veins, which communicate with the anterior chamber and anterior ciliary veins. In its anterior portion the sclera gives passage to the anterior ciliary arteries, veins and nerves; at the equator, to the venæ vorticosæ from the choroid, and, more posteriorly, to the posterior ciliary arteries and nerves. The inner surface of the sclera is brownish from the presence of pigment cells, and is closely connected to the choroid and ciliary body. To its outer surface is attached the tunica vaginalis, or Tenon's capsule.

What is scleritis?

An inflammation of the sclera, characterized by a dusky crescent of congested vessels upon the outer side of the cornea, or purplish spots upon the anterior

portion of the sclera, with swelling of the portions affected, dull pain, lachrymation and fatigue of the eyes. The inflammation is of low type, and if it does not appear in the ciliary region, gradually extends to it and involves the cornea. There is a frequent tendency to a recurrence of the disease.

What are the causes of scleritis?

It is more commonly seen in women, and appears to be connected with uterine irritation, suppressed menstruation, or the cessation of the uterine function. In men it is often associated with a rheumatic or gouty diathesis. Some cases may be traced to malarial causes, and others to a syphilitic taint; in the latter case a small, gummy tumor may make its appearance in the sclera.

What is the treatment of scleritis?

As the local symptoms are very meagre, the general symptoms must be carefully considered in making a prescription. No local applications are admissible, excepting the use of atropin if the cornea or iris becomes involved. Among the most frequently indicated remedies in this affection are Kalmia latifolia, Arsenicum, Mercurius protoididus, Aurum muriaticum, Thuja, Nux moschata, and Silicea, in the order given. An iridectomy may be necessary if there is much increase in the tension.

What is episcleritis?

An inflammation of the superficial portion of the sclera and its overlying conjunctiva, attended with a slight prominence of the part affected. The tissue of

the conjunctiva over the inflamed portion is hyperemic, but there is no conjunctival discharge. The pain is often more severe than in scleritis and the disease exhibits the same tendency to recurrence.

What is the treatment of episcleritis?

In addition to the remedies noted for scleritis, Terebinthina, Sulphur and Pulsatilla may be indicated.

What is sclerotico-choroiditis anterior?

An anterior staphyloma of the sclera, which may arise by extension of an inflammatory softening or atrophic process, or as the result of choroiditis, scleritis or intraocular tumors. The thinnest part of the staphyloma becomes prominent and bluish and the internal parts are usually distended and atrophied. It may be partial or complete. When the whole anterior portion of the eye is involved so as to prevent closure of the lids, the condition is called *buphthalmos;* if there is uniform ectasia or distension of the whole eyeball from increase in its fluids, with increased tension, the condition has been termed *hydrophthalmos.* The vision is usually lost from the implication of the nerve structures, and enucleation is often advisable. The condition may lead to glaucomatous degeneration, or a sympathetic inflammation of the other eye.

What are the causes and treatment of this disease?

Anterior staphyloma of the sclera may arise from an iritis which has involved the angle of the iris and the canal of Schlemm, or from iridocyclitis, or incised wounds in the ciliary region. Nothing can be done for

the condition when it is once established, except to remove the eyeball if it becomes a source of irritation to the other, or for cosmetic purposes.

What is sclerotico-choroiditis posterior?

A posterior staphyloma of the globe, more frequent than anterior staphyloma, and is the productive cause of many cases of myopia. It usually occurs at the posterior pole on the temporal side of the optic nerve, and with the ophthalmoscope appears as a perfectly white spot in the shape of a crescent from which the choroid has been retracted, or later involves the whole of the sclera about the optic nerve entrance, forming an irregular ring.

What is the treatment of posterior staphyloma?

The treatment consists in the administration of those remedies useful for the secondary disturbances of myopia and the observance of such hygienic measures as are indicated in cases of progressive myopia.

Diseases of the Iris.

Describe the iris.

The iris is a circular membranous structure composed of muscular fibres, pigment, epithelium, connective tissue, blood-vessels, lymphatics, and nerves of every type. It is perforated by a round opening, the pupil, at or near its center. At its periphery it is attached to the sclera at the edge of the endothelium of the cornea by the ligamentum pectinatum, formed from the membrane of Decemet, which serves as a support to the

iris. It rests upon the anterior capsule of the lens, over a large area, thus dividing the aqueous humor, in which fluid it floats, into two divisions, the anterior and posterior chambers. The sphincter muscle of the iris is comprised of circular muscular fibres arranged around its pupillary margin and is controlled by the motor-oculi nerve. The iris, by the contractility of its fibres, regulates the amount of light admitted to the eyeball. From an interference phenomena of light caused by its uneven anterior surface and from the brown pigment cells imbedded in its tissue, the tint to the eye is given. At the circumference of the iris it is continuous with the ciliary body and choroid, its posterior surface being covered by dark pigment cells continuous with the uvea or retinal layer of pigment cells, which also cover the choroid and ciliary body. From before backward, the iris is composed of, first, a layer of endothelium, then the stroma of the iris, consisting of bundles of radiating and interlacing fibres of connective tissue, which form a framework in which are found the muscular fibres, blood-vessels and nerves, and in colored irides the pigment cells, and then posterior to the stroma, the uveal or pigmentary layer. Its vascular supply is obtained from the circular arterial anastomosis in the ciliary muscle. Its nerve supply is derived from the ciliary nerves, which are branches of the third, fifth and sympathetic, through the ciliary ganglion.

What is the function of the iris?

To regulate the amount of light admitted to the eye.

How is this done?

By the contraction and dilatation of the pupil.

What is the pupil?

The circular opening in the iris which appears black and surrounded by the color tint of the iris. The size varies from one to eight mm. in diameter; a pupil of average size being about four mm., but larger in childhood and smaller in those advanced in life.

What change occurs in the pupil during accommodation?

It contracts as the eyes are converged, and again dilates as the visual axes become more parallel.

What is meant by the reaction of the pupil?

Its power to contract as the light, which falls upon the eye, increases in intensity, or dilate as the light is diminished. The pupil of one eye reacts also to the light which falls upon the retina of the other.

How is the reaction of the pupil tested?

By throwing the light into the pupil by means of an ophthalmoscopic mirror, which is held a foot or more from the patient during the examination in a dark room. The observer, with his eye back of the opening in the ophthalmoscope, watches the behavior of the pupil as the light is alternately thrown into the eye or away from it. It should contract with the light and dilate when the eye is in comparative darkness.

What is the value of this reaction in diagnosis?

If the eyes are blind and there is no reaction of the pupil, the lesion which causes the blindness is situated in the opitical centers at the base of the brain, in the optic tracts, optic nerve or retina, while if there is

blindness and the pupil still reacts, the cerebrum is the seat of disease.

What is the Argyll-Robertson pupil?

A pupil which does not react to light but contracts when the eyes are converged. This phenomenon is found in locomotor ataxy, general paralysis, and in rare instances in insular sclerosis.

What disorders of the iris exhibit changes in the pupil?

Mydriasis or a persistent dilatation of the pupil results from the sphincter of the pupil having lost its power of contractility, owing to paralysis of the third nerve, due to drug or disease effect. Myosis, a persistent contraction of the pupil, results from an irritative lesion of the third nerve, paralysis of the sympathetic or from drug action.

What diseases may cause mydriasis?

Mydriasis from reflex irritation may occur in hyperemia of the cervical portion of the spinal cord and in spinal meningitis, in the early stages of new growths in the cervical portion of the cord, in cases of intracranial tumor and other diseases causing high intracranial pressure, in the spinal irritation from chlorosis, as a premonitory sign of tabes dorsalis, in cases of intestinal irritation and helminthiasis, in psychical excitement as in acute mania, melancholia, paresis, etc., and from some other forms of cerebral irritation and disease.

What drugs produce mydriasis?

Atropin, duboisin, homatropin, hyoscin, gelsemium, scopolamin, cocain and others, which act chiefly by

paralyzing the terminal fibres of the third nerve, except cocain, which acts mainly by stimulating the sympathetic.

What diseased conditions may produce a reflex myosis?

Irritation myosis is found in the early stage of all inflammatory affections of the brain and its meninges, in cerebral apoplexy, in the early stages of intra-cranial tumors situated at or near the origin of the third nerve or in its course, in destructive lesions of the cervical sympathetic, the spinal cord or of the cilio-spinal center, in tobacco amblyopia, as a reflex action in ciliary neurosis, or at the beginning of an hysterical or epileptic attack, and as the result of prolonged effort of accommodation.

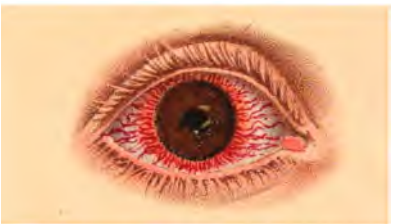
What drugs produce myosis?

Eserin and pilocarpin are the most important, and act chiefly by stimulating the peripheral ends of the motor oculi.

What is iritis?

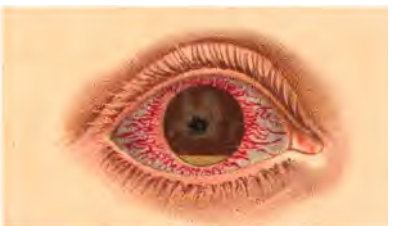
An inflammatory condition of the iris, characterized by vascular engorgement and exudation into its tissue. If the exudation is serous, there is swelling of the stroma and turbidity of the aqueous humor without much tissue change. If, however, the exudation is plastic, it tends to fill the pupillary space and cover the anterior and posterior surfaces of the iris with a tenacious membranous formation. When the exudation is purulent the pus cells extend through the iris tissue, appear upon its surface or collect in the anterior chamber and form an hypopyon.

Plastic Iritis.



Syphilitic Iritis with gumma.

Posterior Synechia.



Hypopyon.

What are the forms of iritis?

According to the character of the inflammatory exudation they are designated as serous, plastic and suppurative iritis, and according to cause, as rheumatic, syphilitic, traumatic and tubercular.

What are the symptoms of iritis?

Neuralgic pain, especially severe in acute cases, which is referred to the temple, forehead, eyebrow or side of the nose, and may be of a dull, constant, aching character or occur in sharp paroxysms often aggravated at night. The vision is defective, the eyes are irritable and photophobia is complained of. The color of the iris is always changed, becoming darker than normal and of a blurred or muddy appearance; the mobility of the iris is impaired, its action retarded, and the pupil usually small and often irregular. The ciliary vessels are markedly injected and form a rosy zone which encircles the cornea in the early stages, but later the injection of the eyeball becomes general.

What are synechiæ?

Adhesions of the iris to the cornea or lens. When the iris is united to the cornea it is called anterior synechia, and results from wounds or ulcerations of the cornea; when adherent to the lens it is termed posterior synechia and is the common result of iritis.

What is serous iritis?

That form of iritis characterized by an exudation of serum from the iris. Deposits of lymph are found on the posterior surface of the cornea, forming dots arranged in the shape of a pyramid with its base at the lower portion of the cornea and its apex at the center

of the cornea. The pupil is sluggish in action and somewhat dilated, the aqueous is turbid and vision is proportionately impaired.

What is spongy iritis?

That form of iritis characterized by an exudation of blood plasma from the iris into the anterior chamber, which coagulates in the aqueous, filling the anterior chamber with a spongy mass. Pain, pericorneal and conjunctival congestion are well marked, but the tendency to formation of deposits on the posterior surface of the cornea or the adhesion of the iris to the lens is not so great as when the exudation is plastic. When the exudation ceases, the coagulated mass shrinks and may finally disappear, although traces of it may remain for a long time.

What is plastic iritis?

That form of iritis which from the plastic character of the iritic exudation produces great tendency to adhesions between the iris and lens and occlusion of the pupil so as to greatly impair or destroy vision.

What is rheumatic iritis?

A form of iritis due to rheumatism or gout, which may present either the serous or plastic variety of inflammation, but is more often plastic in nature and acute in course and exhibits a tendency to recurrence.

What is syphilitic iritis?

This form of iritis, a manifestation usually of secondary syphilis, may appear in the serous, spongy or a gummous form, but is usually plastic. Both eyes are commonly affected, but not at the same time nor to the

same extent. The course of the disease may be acute or chronic and gummata develop in the substance of the iris. The gummata are at first small and may be single or multiple, appearing about the margin of the pupil. When small, they are of a dusky red color and slightly elevated, and when large are yellow in color and tumor-like in appearance.

What is suppurative iritis?

A form of iritis whose characteristic feature is that pus cells fill the tissue of the iris, and are also exuded into the anterior chamber. When not due to injury, it is usually associated with a low state of health. Suppuration of the whole uveal tract usually occurs.

What is the treatment of iritis?

In every case of iritis the first thing to be done is to use atropin to dilate the pupil, because it relieves tension of the eyeball, prevents adhesions forming between the iris and the lens or between the opposite margins of the pupil, otherwise the pupil might become blocked with lymph. It also gives rest to the inflamed tissue and ameliorates the pain. A drop of a one per cent. solution of atropin is to be placed inside the lower lid every half hour until the whole iris, or such portions of it as are not bound down by adhesions, is fully dilated. Afterward a drop every two or three hours, or less, may be sufficient to maintain the dilatation of the pupil. All use of the eyes for near work must be forbidden; generally confinement to the house is advisable, and in severe cases to the bed, where a more even temperature can be maintained, as all cases of iritis are

quickly affected by changes in temperature or by atmospheric influences. The eyes should be shaded or protected from light. When the pain is so severe as to prevent sleep and interfere with recovery, the affected side or whole head should be enveloped in a layer of cotton batting and secured by a nightcap or bandage. The acute attacks of pain which commonly occur during the night demand the application of hot compresses, bags of hot bran or salt, or of flannels dipped in hot water, until the pain is modified or relieved. When atropin seems to exert but little influence on the condition and the pain is not controlled, the continuous application of flannels wet with a hot decoction of hops and chamomile flowers will often have a soothing effect and render the absorption of the mydriatic more speedy. When a marked increase in the tension of the eyeball occurs, an iridectomy should at once be made, as this will relieve the tension and shorten the attack.

What are the indications for the remedies in iritis?

Aconite.—In the first stage of an attack which appears after injuries to the iris. In other varieties arising from exposure to cold in which the inflammation appears sthenic from the inception of the attack.

Arnica.—Recommended for iritis arising from traumatic causes, and in some cases of rheumatic iritis.

Asafetida.—In the plastic variety, occurring particularly in females and from acquired syphilis. The pains are very characteristic, and are described as of a throbbing, beating or burning character in the eye,

and above or around it, and lessened by rest and pressure, as of the face or side of the head on the pillow.

Aurum muriaticum.—May be indicated in some cases of iritis occurring in syphilitic subjects where the pains are described as seated deep in the bones about the eye and are of a tearing, pressing character, and extend from above downward and from without inward.

Belladonna.—The choice between Aconite and Belladonna becomes necessary in the early stages of iritis, and will have to be made according to the concomitant symptoms. Under Belladonna there is usually marked photophobia and contraction of the pupil.

Bryonia.—More useful in the serous forms of iritis, but is also indicated in the plastic when occurring in rheumatic patients. There is soreness and aching in the eyeball and orbit, and sharp, shooting pains which extend through the head or face; or pressure under the orbit as if the eye would be forced out, may be complained of. The eyeballs are often sensitive to the touch and painful on motion.

China.—Indicated in iritis occurring in debilitated subjects, and with a marked periodicity, or when arising from malarial causes.

Clematis.—This remedy is highly recommended for the various forms of iritis when accompanied by little pain and great sensitiveness to cold air. It is claimed to have a marked absorbent action upon the synechiæ.

Gelsemium.—The most valuable remedy for the serous variety. The special eye symptoms in this variety of inflammation are not marked.

Hepar sulphur.—Serviceable in any variety of iritis, and particularly indicated in the suppurative form with accompanying hypopyon. The pains are usually throbbing and intense, with great sensitiveness of the eye to touch. Warm applications seem particularly pleasant.

Kali iodidum.—Very useful in either the plastic or serous forms, particularly from syphilitic causes.

Mercurius solubilis.—This remedy is often valuable in plastic iritis occurring during the course of syphilis. The pains are usually severe but may vary much both in character and intensity. There is aggravation of the pains at night and after going to bed, soreness of the head on the side of the affected eye. The lachrymation is usually acrid.

Mercurius corrosivus.—Frequently indicated in all forms of iritis. The symptoms are very similar to those of the Mercurius solubilis but usually much more intense.

Nitric acid.—A valuable remedy in chronic and recurrent iritis in syphilitic patients. The inflammatory symptoms are usually asthenic and the pain is often worse during the day than at night.

Rhus toxicodendron.—In plastic and suppurative iritis following operations upon the eyeball, or plastic inflammation associated with a rheumatic diathesis; the symptoms are intense and accompanied by chemosis and swelling, and spasmodic closure of the lids.

Spigelia.—Very suitable to cases of mild iritis where the inflammatory symptoms are not marked, yet

accompanied by severe neuralgic pains in and around the eye.

Sulphur.—In the suppurative variety with hypopyon, or in the more chronic forms. The symptoms are variable and the prescription must be made upon the concomitant conditions.

Terebinthina.—A very important remedy for the plastic variety when presented in rheumatic patients, with the urinary symptoms characteristic of the remedy.

Thuja.—In plastic iritis of syphilitic subjects where gummata are developed in the tissue of the iris.

Among other remedies which may be useful in special cases are Pulsatilla, Cedron, Silicea, Cimicifuga and Prunus spinosa.

Describe the operation of iridectomy.

It consists in excision of a portion of the iris. Having anesthetized the eye with cocain, the patient is

Angular keratome.

Graefe's linear cataract knife.

Iris forceps, curved.

placed upon the operating table, in a good light, and the speculum introduced. Then seizing the conjunctival tissues opposite the site of the operation with

fixation forceps to steady the globe, an incision is made in the margin of the cornea with an iridectomy or cataract knife, nearest the art of the iris to be premoved, and if the iris does not prolapse with the escape of the aqueous, an iris forceps is introduced and the part of the iris to be excised is drawn outside the corneal incision and cut off. The stump is then carefully returned within the anterior chamber, allowing none of it to remain in the corneal incision, and the eye is bandaged until the corneal incision has united.

What tumors of the iris are found?

Cysts, which usually appear as transparent vesicles upon the surface of the iris and require for their removal an excision of that portion of the iris to which the cyst is attached. Sarcoma of the iris is a rare affection, and when accurately diagnosed the removal of the eyeball is the proper treatment.

Diseases of the Ciliary Body.

What is the general anatomy of the ciliary body?

The ciliary body consists of a plaited zone containing the ciliary process and the ciliary muscle lying between the iris and the ora serrata, and is a direct continuation of the choroid. It is composed of the ciliary processes, meridiona folds of the choroid some seventy or eighty in number, which rise gradually from the ora serrata and are continued forward to the iris. In the depressions formed by the plaits, fit corresponding projections of the zonule of Zinn, a transparent

membrane continuous with the envelope of the vitreous and which also forms the suspensory ligament of the lens. The ciliary muscle, consisting of grayish unstriped muscular fibre, occupies the anterior and more internal portion of the ciliary process and sclera and is supplied by a filament from the third nerve. The ciliary body is firmly joined to the sclera and is largely supplied with fine blood-vessels, which form two arterial circles, affording nourishment to the lens and secreting the aqueous humor. It is highly supplied with ciliary nerves derived from the long and short ciliary, which form a rich plexus with minute nerve ganglia in its tissue, while all the nerves which go to the iris pass through it.

What is cyclitis?

An inflammation of the ciliary body characterized by injection of the vessels of the ciliary zone, congestion of the conjunctiva, intense photophobia and lessened vision, without marked change in the iris beyond a hyperemic condition. The anterior portion of the vitreous becomes clouded, rendering ophthalmoscopic examination impossible. Severe neuralgic pains affect the whole eyeball and side of the head, even extending down the neck. Tension may be increased, a suppurative stage may even be entered upon without a purulent inflammation of the iris occurring, and pus may appear behind the lens or in the anterior chamber.

What are the causes of cyclitis?

Low conditions of the system, suppressed menstruation, and slight or ill-treated attacks of iritis seem to

excite it. It may occur after typhoid or scarlet fever in children, or from syphilis, rheumatism and struma, and as consequent to diseases of the cornea.

What is the treatment of cyclitis?

Hot applications, moist or dry, according to the comfort of the patient, should be used and absolute rest of the eye prescribed during the attack of the inflammation and for a long period after recovery. The general treatment of the acute affection is similar to that of iritis, and atropin or duboisin are to be used as in iritis. The diet should be nutritious and generous. The chief reliance must be placed upon the use of internal remedies, which have the same indications as for iritis. The most frequently indicated remedies are Belladonna, Bryonia, Gelsemium, Hepar, Kali iodidum, Mercurius corrosivus or iodidum, Rhus tox. and Silicea.

What is irido-cyclitis?

An inflammation of the iris which has extended to the ciliary body, exhibiting either a serous, plastic or purulent form; there is consequently exudation and swelling of the structures of both, with exudation into the anterior chamber and behind the iris. The vascularity and pain are greater than when the iris alone is affected, and there is excessive tenderness and pain when the ciliary region is touched through the closed lid by the finger. Vision is greatly impaired from opacities in the aqueous and vitreous and there is scarcely any dilatation of the pupil when atropin is used. In the serous variety, which is more rare,

there is increased tension in the acute form, while in the chronic form the tension is below normal and the disease results in atrophy of the globe or phthisis bulbi. The iris is discolored, often grayish or atrophied. In the plastic inflammation the iris becomes attached over the whole surface of the lens and dense masses of exudation fill the posterior chamber and extend into the vitreous. These masses of exudation subsequently contract, drawing the iris backward, deepening the anterior chamber and bringing about changes in the ciliary body itself, the vitreous and also the lens. When the condition is suppurative it rapidly involves the whole eye, producing panophthalmitis with complete destruction of the vision. The prognosis is always grave.

What are the causes and treatment of irido-cyclitis?

The causes are the same as those of cyclitis, and the treatment does not differ from that of the various forms of iritis which may involve the ciliary body.

What is traumatic cyclitis?

A form of inflammation of the ciliary body arising from such injuries as wounds or lacerations of the eyeball in the ciliary region. Penetration of the ciliary body by small bodies of any description, or their lodgment in it, is very prone to excite a most destructive inflammation of the part and is a very common cause of sympathetic ophthalmia. The ciliary body, under these circumstances, becomes the seat of a plastic inflammation which rapidly disturbs the relation to each other of the interior structures of the eye. Masses

of exudation infiltrate the ciliary body and oftentimes extend out through the vitreous and deposit upon the retina, which, after a time, contract and cause a separation of the retina from the choroid, or even detachment of the ciliary body from the sclera.

What are the symptoms and treatment of traumatic cyclitis?

The symptoms do not differ from those of cyclitis from other causes. The treatment in the beginning should be cold applications, as the attack may be aborted by their use. After the disease is once established it is treated as indicated in cyclitis. Later it may become necessary to remove the eyeball. If there is a foreign body in the ciliary body or within the eyeball, and cyclitis is imminent, enucleation should be done at once.

What is cycloplegia?

A paralysis of the ciliary muscle which causes total loss of power of the accommodation and is usually associated with mydriasis from paralysis of the sphincter pupillæ, as both are supplied by branches of the motor fibres of the ciliary ganglion. One eye alone is usually affected, although the paralysis may affect both.

What are the causes of cycloplegia?

It may arise from idiopathic, traumatic, syphilitic and rheumatic causes affecting the third nerve, or result from the use of mydriatic drugs. The lesion may be central or peripheral, and occurs not infrequently after diphtheria.

What is the treatment of cycloplegia?

Treatment must be directed to the cause. When uncomplicated the use of such remedies as Gelsemium, Causticum, Argentum nitricum, Duboisia, Physostigma, Kali iodidum, or Opium may be beneficial. Faradization or galvanization is often of benefit in addition to the internal remedies. Eserin or pilocarpin locally, is sometimes of benefit by stimulating the paralyzed muscle.

What is accommodative asthenopia?

A paresis of the accommodation, more common than paralysis, and is not accompanied by any change in the mobility of the eyes. It is frequently associated with potential weakness of the extrinsic muscles of the eyeball. Inability to use the eyes for any length of time without fatigue, indistinctness or blurring of the object, especially in near work, is frequently complained of, together with headache around or beyond the eye, and perhaps nausea and other reflex symptoms. When the condition has existed for a time, conjunctival or retinal hyperemia may result.

What are the causes of accommodative asthenopia?

The common causes of loss of tone of the ciliary muscle are refractive errors; these may be very slight and will require careful investigation. Hyperopia and astigmatism are often exciting causes, especially in neurasthenic cases. It may occur as a sequela of typhoid and acute exanthematous diseases or as a reflex disturbance from other causes.

What is the treatment of accommodative asthenopia?

When due to refractive errors, the proper correction

and prescription of glasses is requisite. Improvement in the general tone of the patient is essential; a good and generous diet, with moderate bodily exercise, the galvanic current and methodical reading exercise are all valuable adjuvants in the treatment.

What are the indications for remedies in accommodative asthenopia?

Gelsemium. — A valuable remedy in paresis or paralysis of the ciliary muscles, particularly when due to diphtheria.

Duboisia.—Paresis of the ciliary muscle. The accommodative effort can be sustained only momentarily, and hyperemia of the conjunctiva and lachrymation occur upon use of the eyes.

Conium.—The letters run together on reading and the effort brings on vertigo or headache. Burning pain deep in the eye may be complained of, and the light is usually disagreeable or painful.

Physostigma.—While more valuable in spasmodic affections of the ciliary muscle, it is also curative in some cases of paresis of the ciliary muscle following diphtheria.

Argentum nitricum.—Paresis following diphtheria, or in hyperopes, and weakness of the accommodation after herpes frontalis.

Lilium tigrinum.—Weakness of the accommodation, which has been preceded by an irritable condition of the ciliary muscle. There is usually photophobia, burning, smarting and heat of the eyes after use, and general relief of the eye symptoms in open air.

Jaborandi.—Alternate contraction and relaxation

of the ciliary muscle associated with uterine disturbance or with refractive errors. The effort to read or use the eyes for near work frequently causes nausea and even vertigo.

What is spasm of the accommodation?

An excessive tension of the ciliary muscle. This converts a low degree of hypermetropia, or even a high one, into emmetropia or even into myopia.

What are the symptoms of spasm of the accommodation?

It occurs almost exclusively in young persons, especially in those in school or college. Such persons suffer from asthenopia and defective vision for distance. Vision may seem to disappear temporarily when the eyes are used for fine work, or headaches, vertigo or other reflex symptoms result from continued use of the eyes.

What is the treatment of spasm of the accommodation?

Complete rest of the eyes must be enforced; and the most effective treatment consists in giving the ciliary muscles rest by the daily use of atropin solution until there is a complete relaxation of the spasm, when the true condition of refraction should be determined and the necessary glasses worn constantly. In milder cases, rest of the eyes from near work and the use of such homeopathic remedies as will relax the spasm to such a degree that the refractive anomaly may be determined and corrected.

What are the indications for remedies in spasm of the accommodation.

Physostigma.—Particularly serviceable in relaxing

the spasm in myopic eyes; the book is brought closer to the eyes than formerly, and use of the eyes soon becomes uncomfortable or impossible. Twitching of the eyeball is often present.

Jaborandi.—More useful in spasm of the accommodation occurring in hyperopic, myopic or astigmatic patients. The vision seems to disappear temporarily when an attempt is made to look at fine objects. Moving objects, as the people or teams in the street, occasion headache, vertigo or nausea.

Agaricus.—Useful in spasm of the ciliary muscle when accompanied by spasmodic conditions of the lids or ocular muscles.

Lilium tigrinum.—Spasm of the accommodation in light degrees of myopic astigmatism, when cylindrical glasses are indicated and yet are not worn with comfort. It has a marked effect in relieving the asthenopic symptoms which accompany these cases of spasmodic action of the ciliary muscle.

Sympathetic Ophthalmia.

What is sympathetic ophthalmia?

Sympathetic ophthalmia is an affection in which one eye is implicated as the result of disease or injury of the other, and presents two essentially different conditions, one a sympathetic irritation and the other a sympathetic inflammation.

What is meant by sympathetic irritation?

By this term is meant a sympathetic neurosis or

functional disturbance which presents a series of symptoms, with a tendency to recurrence, comprising photophobia, lachrymation, blepharospasm, defective or impaired accommodation, lessened visual acuity, inability to perform close work, supraorbital neuralgia, photopsia, contraction of the visual field and hyperemia of the eye-ground, and often some tenderness on pressure over the ciliary region.

What is sympathetic inflammation?

A sympathetic ophthalmia presenting an iridocyclitis or keratitis, a serous iritis or a chorio-retinitis in one eye which results from disease or injury of its fellow, the exciting eye.

What are the causes of sympathetic ophthalmia?

Sympathetic ophthalmia occurs principally from injuries of the iris and ciliary body and the irritation which foreign bodies produce, especially when located within the eyeball. Contraction of cicatrized tissue, bony deposits in the choroid, displacement of foreign bodies which had become encysted, or the wearing of an artificial eye upon a shrunken stump, may also awaken a dormant tendency to sympathetic irritation and set up an inflammation within the other eye, by sympathy of structure through the ciliary nerves, by migratory infection by way of the sheaths of the optic nerves, or possibly through other channels not at present known.

What are the symptoms of sympathetic inflammation?

This condition may occur in from a few days to six weeks or more after the reception of injury or disease

of the exciting eye, and is characterized by a marked sensitiveness over the region of the ciliary body in the sympathizing eye, with symptoms such as result from disease of the part affected, which vary according to the severity and stage of the disease. Sympathetic ophthalmia usually assumes the form of a plastic inflammation of the iris and ciliary body, or iris and choroid, with a marked tendency to adhesion of the iris over the whole extent of the lens, causing complete posterior synechia; the iris thus becoming immobile and the pupil frequently filled with the plastic exudation. The tension, which early in the attack is increased by the choking up of the channels of exit at the corneal junction, later becomes lessened from pressure of the exudation upon the blood-vessels and nerves. These changes interfere with the nutrition of the lens and vitreous and result in partial or complete atrophy of the eyeball.

How is the diagnosis of sympathetic inflammation made?

The early sympathetic phenomena in the more common form of inflammation, that of irido-cyclitis, are intolerance of light, ciliary injection and discoloration of the iris. The iris exhibits a marked exudation and a tendency to become adherent to the lens, speedily bringing about complete posterior synechia. It becomes immovable and vascular and the pupil is filled with plastic exudation. The injection of the ciliary zone is soon followed by a general injection of the eyeball, and the appearance of the ball is that of deep inflammation. The pain may be dull or severe, with an exquisite tenderness to touch or pressure in the ciliary

region. The sight is rapidly lost; the condition of the other eye determining the probability of its being the exciting cause of the inflammation.

What is the prognosis in sympathetic irritation and inflammation?

The prognosis in the stage of irritation may be said to be favorable if the exciting eye is removed before the stage of irritation becomes one of inflammation. When the condition becomes one of acute inflammation the prognosis, even upon removal of the injured or diseased eye, is grave.

What is the treatment of sympathetic inflammation?

The most important consideration of treatment is prophylaxis, or the management of the eye originally affected. This depends upon the character and situation of the wound or upon the stage of the disease and upon the amount of vision possessed by the injured or diseased eye. By enucleating or removing the exciting or injured eye before the inflammatory changes resulting from the sympathetic disturbance have taken place, or immediately upon the appearance of sympathetic irritation, the condition may be aborted and recovery of the sympathizing eye established. After the disease has become one of sympathetic inflammation nothing is to be gained usually by the removal of the exciting eye. In the latter case both eyes are subjected to such treatment as the condition would indicate, the effort being made to preserve as much vision as possible under the circumstances in both eyes; for, as frequently happens in such cases, the original eye affected often retains some vision, while its participating fellow undergoes

such destructive inflammation as to become entirely blind. Thus the possibility of complete surveillance of the patient, the cause, condition, duration, and amount of inflammation already established in the sympathizing eye, as well as the amount of destruction to the exciting eye, must be taken into consideration before operative measures are decided upon; but in the majority of cases the prompt removal of the cause of the irritation, by enucleation or otherwise, is justifiable and offers the greatest chance of retaining vision in the remaining eye.

How is the operation of enucleation performed?

The patient being anesthetized and the speculum introduced, the conjunctiva is divided close to the cornea by curved scissors, the muscles successively raised upon the strabismus hook and divided close to the sclera, then the scissors introduced, following the convexity of the eyeball until the optic nerve is reached and divided; the ball is then held by the fingers or forceps and the tissue carefully dissected until it is entirely free from the capsule of Tenon and is then removed. The orbit is then sponged with cold water until the hemorrhage has ceased, a wad of absorbent cotton placed upon a bit of soft muslin over the closed lids and a compress bandage applied for twelve hours, when it is removed and the orbit and lids kept wet with a decoction of calendula flowers or some antiseptic lotion until healing is complete. As soon as the tissues of the orbit have recovered from the effect of the operation an artificial eye may be worn.

What other operative measures are sometimes employed?

In order to avoid the necessity of removal of the

eye and the consequent use of an artificial one, the operations of optico-ciliary neurotomy and neurectomy have been devised, which consist in the division of the optic and ciliary nerves with the curved scissors, which are introduced through an opening made in the conjunctiva, and the eyeball forcibly rotated upon its axis so as to admit of the nerve trunks being severed from the eyeball. In the former operation, the conjunctival incision is made at the outer canthus and the tendon of the external rectus temporarily divided, while in the latter operation, which is performed at the inner canthus, no division of the muscles or tendons is necessary.

Diseases of the Choroid.

Describe the choroid.

The choroid is the nutrient membrane of the interior structures of the eyeball and consists of two layers of blood-vessels held in position by a stroma of connective tissue. It extends from the optic nerve entrance nearly to the sclero-corneal junction, where it ends in a series of plaits or folds, the ciliary processes, which together with the ciliary muscle form the ciliary body. In the choroid four layers are described which are separated by endothelial cells which also envelope the blood-vessels. The most external layer is the lamina supra-choroidea. The next layer, the tunica vasculosa, or layer of large blood-vessels, presents the major portion of the stroma of the choroid, which consists of striated fibre cells and pigment cells of various forms uniting the elements of the choroid

together. The third layer, or chorio capillaris, contains the capillary divisions of the arteries and veins of the tunica vasculosa. The remaining layer is the lamina vitrea or elastica, a structureless, or finely fibrillated, transparent membrane covering the layer of capillary vessels and upon which rests the layer of hexagonal pigment cells of the retina. Its arterial supply comes from the ciliary arteries and its numerous nerves are derived from the third, fifth and sympathetic through the long and short ciliary nerves which form fine plexuses in the choroid with many ganglionic cells.

What is choroiditis?

An inflammation of the choroid characterized by an exudation in its tissue, which, as serous, plastic, purulent or tubercular, determines the form of inflammation.

What is the etiology of choroiditis?

Choroiditis is generally due to inherited or acquired syphilis and appears usually at a more or less remote period after the primary and secondary stages have passed. It also results from injuries to the eye, arising also idiopathically as the result of a low state of the system or as a sequel of severe constitutional diseases, and may be reflex from uterine hyperplasia or be metastatic following parturition. Myopic eyes of high degree show a predisposition to choroiditis which often follows unusual eye strain or abnormal conditions of the nervous and circulatory systems.

What are the principal forms of choroiditis?

Serous, plastic and suppurative choroiditis.

What are the symptoms of serous choroiditis?

There is a diffuse haziness of the vitreous with minute floating opacities. There is some fullness of eyeball, more or less congestion of the sclera near the cornea, and if the iris is implicated, the pupil is dilated and sluggish. Increased tension is often noticeable and in an attack of serous choroiditis we have all the symptoms of glaucoma.

What is plastic choroiditis?

In plastic choroiditis the exudation appears in small patches which remain separate or unite to form larger ones. The exudation is fibrinous and is in close proximity to the retina, so that the retinal pigment is disturbed or proliferated. When the exudation has been absorbed, the stroma of the choroid is found destroyed and on examination with the ophthalmoscope the white of the sclera is seen shining through the atrophic spot which is fringed around the margin with dark pigment, and forms the characteristic picture of this variety of choroiditis. There is no special pain and the only complaint is usually that the eyes are weak and that the vision is not distinct or that it is much impaired.

What is central choroiditis?

A form of plastic choroiditis in which the inflammation is confined to the macula lutea.

What is disseminated choroiditis?

A plastic choroiditis in which there is usually a number of patches of various sizes in different portions of the choroid with comparatively healthy tissue between the patches.

What is sclerotico-choroiditis posterior?

A plastic choroiditis which occurs at the temporal side of the optic disc and in which the sclera becomes implicated. The choroid atrophies and the sclera distends under the pressure of the contents of the eye and bulges outward, forming posterior staphyloma. It is the frequent accompaniment of progressive myopia and the myopia is rapidly increased by the distension of the eyeball.

What is suppurative choroiditis?

This disease is distinguished by a suppurative process between the retina and choroid, which extends into the vitreous and involves the ciliary body and iris. It results from suppuration following perforating wounds of the eyeball or the entrance of foreign bodies; from sloughing ulcers of the cornea and from metastasis in pyemia, puerperal sepsis, septicemia, cerebro-spinal meningitis and endocarditis. It is usually sudden in its onset and pursues an acute course, the lids swell, the eyeball becomes inflamed, intensely painful, and is rapidly filled with pus. The vision is destroyed at once. The inflammation may be such as to distend the ball with pus so as to cause a rupture of the globe, which would necessitate the removal of the ball. As the inflammation subsides, if the globe does not rupture, the eyeball becomes smaller and softer.

What is the treatment of choroiditis?

The serous form requires in general the same treatment as that of serous iritis, and when there is marked increase of tension, a paracentesis of the cornea or an iridectomy will be required. Kali iodidum, Bryonia

and Gelsemium are frequently indicated. In plastic choroiditis the treatment consists mainly in the protection of the eyes from strong light, the avoidance of all close use of the eyes, and in severe cases confinement in a darkened room may be necessary. The diet is to be regulated, the general health to be improved and syphilitic causes combatted. The use of such remedies as Aurum, Belladonna, Bryonia, Gelsemium, Kali iodidum, Mercurius, Nux vomica, Phosphorus, Pulsatilla and Sulphur will be found efficient in controlling and curing the disease. In the suppurative form the process is sometimes arrested by Hepar sulphur, Rhus tox. or Silicea; if not, our attention is to be directed to the relief of pain and the prevention of extension of the inflammation beyond the eyeball.

What tumor is developed from the choroid?

The most frequent neoplasm of the choroid is sarcoma, which occurs between thirty-five and fifty years of age, springs from the choroid, and in the early stages may be recognized with the ophthalmoscope. In its growth it fills the globe, and if the eyeball is not removed before this occurs, the tissues of the orbit become involved.

What is the appearance of tubercles of the choroid?

Tubercles appear in the choroid as minute yellowish white spots which, owing to their diminutive size, are difficult to detect.

What is ossification of the choroid?

In advanced life, in eyes that have long been blind from injury or destructive inflammations, plates, spicula

or complete shells of bone form in the choroid and become sources of pain and inflammation or excite sympathetic ophthalmia. The eyeball should be enucleated.

What is coloboma of the choroid?

A congenital defect of the choroid in which there is a loss of its tissue, through which the sclera is visible, and the vision is diminished as the undeveloped portion of the choroid is in close proximity to the central portion of the retina.

What is albinism?

A congenital absence of the pigment layers of the retina and stroma of the choroid, of the iris and other portions of the eye, as well as that of the skin and hair of the individual. The person so affected suffers from the excess of light which enters the eye, and also from defective vision.

Glaucoma.

What is glaucoma?

A condition of the eye is which there is a disturbance of the equilibrium between secretion and excretion, which results in an increased tension of the eyeball.

What is understood by eyeball tension?

An increased hardness of the eyeball under palpation when compared with other eyes which are supposedly normal.

How is the eyeball tension determined?

By palpation with the fingers through the closed

eyelid, care being taken not to palpate over the tarsus but beyond its upper edge. The alternate pressure of the finger tips gives a sensation of hardness or softness which, when compared with a normal eye, enables one to say that the eyeball under examination is harder or softer than the normal. Any increase of tension is indicated for record as T+ and the various degrees of increase from T+1 to T+3, when the eyeball has attained a condition of hardness such as to give no return on pressure of the fingers. If the tension is below normal, its designation is accordingly T−1, T−2 or T−3, the latter indicating an extreme softness of the eyeball.

What is primary glaucoma?

That condition in which there is an increased tension of the eyeball without any previous indication of disease changes within the eyeball.

What is secondary glaucoma?

That condition in which the increased tension is a symptom or complication of disease or injury of the eyeball.

What are the objective symptoms of glaucoma?

Increased tension, dilatation of the pupil without reaction to light, haziness of the cornea, shallowness of the anterior chamber, engorgement of the veins of the ocular conjunctiva, and when the media are sufficiently clear, a depression or cupping of the optic disc is visible with the opthalmoscope. When the field of vision is taken it will be found contracted and, in

advanced cases, presents only a narrow, vertical field extending up and down from the macula lutea.

What are the subjective symptoms of glaucoma?

Impairment of vision more or less complete, pain varying from a fullness of the eyeball to a neuralgia involving the whole head or the side adjacent to the affected eyeball, which may be associated in acute attacks with fever, nausea and vomiting. Halos around the light, or prismatic rings, are frequent accompaniments of increased eyeball tension. In all cases there is usually a rapid increase of presbyopia requiring frequent changes of glasses.

What are the varieties of glaucoma?

Those which occur from causes due to changes in the eyeball tissues when not previously in an inflammatory condition are designated as primary, or simple, inflammatory, hemorrhagic and fulminating or malignant, and those which occur as the result of acute inflammatory affections of the tissues of the eyeball from disease or injury are termed secondary. All varieties exhibit an increased tension; the former tending to a permanent increase while the latter may present only a temporary increase of tension.

What are the causes of glaucoma?

Primary glaucoma is a disease of advanced life, appearing with greater frequency as the age is increased after forty. A gouty or rheumatic diathesis, senile degeneration of the tissues of the eyeball, as hardening of the sclera, any obstruction to the escape of the fluids of the eye through the spaces of Fontana

Deep cupping of the optic nerve in Glaucoma.

or through the veins from the venæ vorticosæ in their oblique passage through the sclera, have all been given due recognition together with hypermetropia and other refractory errors, as causes of the increased tension, and they are only a few of the many theoretical causes advanced. In the secondary form, the dislocation or swelling of the lens, the blocking up of the exits from the eye at the angle of the iris, by inflammatory exudation, are sufficient to account for the increased tension in some cases. Irritation of the fifth nerve and affections of the teeth also present causes. The use of atropin in the eyes of individuals over forty years of age is likely to induce an attack of glaucoma.

What is simple glaucoma?

Glaucoma is said to be simple when the increase of tension progresses slowly and continuously without inflammatory attacks. The vision is gradually impaired, its field contracted, and the subjective symptoms of lessened accommodation and rainbow colors around the light are present but not constant; objective symptoms beyond a partial dilatation of the pupil are absent.

What is acute or inflammatory glaucoma?

Acute or inflammatory glaucoma usually has a sudden beginning with inflammatory symptoms accompanied by severe pain in the eye and the side of the head corresponding to the eye attacked. The sight is much impaired or lost. The eyelids appear more or less red and swollen, the conjunctiva chemotic, the blood-vessels of the conjunctiva are enlarged, there is usually much lachrymation and intolerance of light.

The pupil is somewhat dilated and immovable, the aqueous turbid and the tension of the globe greatly increased. The ophthalmoscopic examination is usually of little use, as only a dull reflex of light is obtainable, owing to the hazy condition of the media. The acute symptoms may pass off in a day or two or last for weeks, leaving the vision and the eye permanently damaged. Similar attacks may recur and the condition soon become chronic.

What is hemorrhagic glaucoma?

In some cases there is a sudden loss of sight from an effusion of blood in the retina, optic nerve, and occasionally in the vitreous, which without any premonitory symptoms of glaucoma is followed by pain and inflammation with increased tension. Hemorrhages in the retina are often the accompaniment of both primary and secondary glaucoma.

What is glaucoma fulminans?

A form of acute glaucoma characterized by the suddenness of its onset, the intensity of its symptoms and the rapid destruction of vision which is accomplished in a few hours. The attack is usually accompanied by severe pain in the head, and gastric symptoms, which often cause the eye condition to be overlooked.

What is chronic glaucoma?

An acute glaucoma is usually the beginning of the chronic form. The succeeding attacks may be lighter than the first or of the same severity. With the attacks there is increased dimness of vision and more or less

pain in and around the eyeball. The field of vision is found contracted. The interval between the attacks varies from days to weeks or even months. The condition goes on, if not controlled by treatment, to absolute glaucoma.

What is absolute glaucoma?

As a result of acute or chronic glaucoma which is not controlled by treatment, the eyeball becomes stony hard, the pupil dilated and immovable, the iris often atrophic, the cornea hazy, the anterior chamber shallow, the lens more or less opaque, the blood-vessels of the conjunctiva of the ball engorged and tortuous and the vision entirely lost. The eyeball passes into a state of general degeneration and when painful requires enucleation.

What is the treatment of glaucoma?

It is both surgical and medical. The surgical consists in either a paracentesis of the cornea with evacuation of the aqueous and an iridectomy with removal of a large section of the iris, or an incision through the sclera just back of its union with the cornea, or section of the ciliary body. In the employment of any of these operative measures the surgeon must be guided by the condition of the vision, the nature of the attack, and his own judgment as to the selection, indication and time for the particular operation. As a rule, if an operation is advisable the earlier it is performed the better, but in all cases the patient should be informed as to the danger which may follow any operation that involves the opening of the eyeball. While iridectomy

gives perhaps the best result in many cases, no operation yet devised may be said to be curative or restore the vision. For the control of the attack eserin solution one half or one per cent. may be used with benefit, either before or after an iridectomy, and in some cases is sufficient to control the condition without operation. There is little to be done in the way of external applications for relief in glaucoma except that of the use of hot compresses for the pain in acute conditions. Some prophylactic measures are of value to prevent in the more chronic form a recurrence of the attacks. These consist in the correction of disorders of nutrition from eating or drinking, the avoidance of mental or physical exhaustion, the protection of the eyes from excessive light and their non-use for close work. The use of homeopathic remedies when properly indicated has controlled the attacks or modified the disease in many cases. Bryonia, Colocynth, Gelsemium, Nux vomica, Phosphorus and Sulphur are more frequently efficient.

Diseases of the Lens.

What is the location and anatomy of the lens?

The crystalline lens lies between the iris and vitreous body, and with its supporting ligament, the zonule of Zinn, divides the interior of the eyeball into two portions, the smaller, and anterior portion containing the aqueous humor, and the larger posterior portion the vitreous. It is a small biconvex transparent body held in position by its suspensory ligament, and upon its anterior surface, which is convex,

rests the pupillary margin of the iris, when the iris is not dilated. Its posterior surface is more curved than the anterior, and fits in a depression of the vitreous. In shape it is like a biconvex lens with a long diameter of from 8 to 9 mm., and an antero-posterior diameter of 5 mm., and is composed of flat, hexagonal, ribbon-like plates or fibres with serrated edges held together by cement substance. These fibres are S shaped and are so arranged that the ends are brought toward each other while the body of the fibre is toward the circumference of the lens. The fibres are arranged in lamellæ which overlap each other and form three or more triangular-shaped sectors with their apices meeting at the center of the lens. The lens substance is enclosed in a capsule, an homogenous membrane, which is elastic and to which the zonule of Zinn is attached.

How is the nutrition of the lens accomplished?

Suspended, as is the lens, between the ciliary processes with no direct blood-vessels leading to it, its nutrition depends upon the nutrient condition of the fluids which surround it and upon its power of osmosis for these fluids. Beneath the anterior portion of the capsule is a layer of epithelial cells which play an important part in the direction of the nourishment of the lens.

What are the nucleus and cortex of the lens?

In youth, the lens appears of the same density, but after forty years of age the central portion becomes more hard and forms the *nucleus*, while the outer portion remains soft and is called the *cortex*.

What is the function of the lens?

When in a state of rest parallel rays of light passing through it, as with the other refractive media of the eye, tend to converge and form a focus upon the retina. When, however, upon contraction of the ciliary muscle, the suspensory ligament of the lens is relaxed, the elastic fibres of the lens increase its convexity and divergent rays of light are focused upon the retina by the action of the lens.

What is cataract?

Any opacity of the structure of the lens or its capsule arising from want of full development of its fibres, substance or envelope before birth or immediately after, or from insufficient nutrition of its structure from general malnutrition or from inflammatory diseases of its surrounding tissues.

What are capsular and lenticular cataracts?

A capsular cataract is one in which the loss of transparency is in the capsular envelope of the lens. Lenticular cataract occurs when the opacity is in the substance of the lens. Either form may be congenital or acquired.

What are the forms of capsular cataract?

When the opacity is in the anterior capsule it is termed *anterior polar cataract;* when in the posterior envelope of the lens, *posterior polar cataract;* and when upon the anterior surface of the lens it is called *pyramidal cataract;* the latter is occasioned by a deposit of organized lymph upon its surface, while the former usually result from injury or inflammatory diseases which affect the nutrition of the lens capsule.

What are the varieties of lenticular cataract?

Zonular or lamellar, traumatic, nuclear, cortical, mixed and Morgagnian.

What is zonular or lamellar cataract?

An opacity of the lens usually congenital or which develops within a few months after birth. The opacity may be confined to a few fibres, usually near the periphery of the lens, or form one or more concentric opaque rings, while the nucleus and the rest of the cortex remain transparent.

What is traumatic cataract?

When the lens or its capsule is injured from wounds which involve their structure, or from foreign bodies which penetrate them, the lens becomes rapidly opaque owing to the rupture of its capsule, which admits the fluids in which it is suspended to its fibres, and causes their consequent swelling and opaqueness.

What are nuclear, cortical and mixed cataracts?

After forty years of age, the center of the lens has usually become so hardened as to present a greater

Striæ in cortical cataract.

Opaque nucleus in senile cataract.

density than that of the more outside layers. As this portion of the lens is most distant from its sources of nutrition it may suffer first, and becoming opaque, is termed *nuclear cataract.* In a majority of the cases the cortex striæ or lines of opacity are more prominent

and the condition is called *cortical cataract.* When changes are apparent in both the nucleus and cortex, *mixed cataract* is diagnosed.

What is Morgagnian cataract?

A term applied to a degenerative condition of cataract, where in old age the cortical portions of the lens become liquified and the nucleus presents a yellowish appearance in the lower portion of the capsule.

What are the causes of cataract?

Anything which affects the integrity of the lens or interferes with its nutrition is likely to impair its transparency and so produce cataract. Traumatism, senile changes of the eyeball tissues or those resulting from inflammation and malnutrition of the eye, as well as such diseases as diabetes mellitus, albuminuria, or those which occasion great exhaustion of the vital forces.

What are the symptoms of cataract?

Sudden or progressive loss of vision is usually the first symptom complained of, as the changes in the opacity of the lens are not accompanied by pain, except when the cataract follows traumatism or inflammation of other structures of the eye. Senile cataract, nuclear or cortical, is the more common form of cataract which occurs in advanced life without pain and with complaint only of impaired or loss of vision. The examination with the ophthalmoscope shows opaque portions in the red field of the fundus, unless the cataract is complete, when there is no red reflex.

What is the treatment of cataract?

The treatment of cataract should be both medicinal and surgical. Medicinal to lessen the effect of traumatism and to improve the nutrition of the lens by increasing that of the eyeball through the general system of the individual. Efforts in this direction may accomplish much in controlling the advancing opacity of the lens and the maintenance of useful vision during life of the patient. Surgical treatment demands the removal of the lens, with or without its capsule.

When is cataract said to be immature and mature?

When the opacity of the lens is only partial in the acquired form the cataract is said to be unripe or immature. In this condition there is still a red reflex obtainable from the eye; in focal illumination of the iris a shadow of its pupillary edge will be seen in the lens cortex. When mature or ripe, there is no longer any red reflex from the background of the eye, the shadow of the iris is no longer visible and the sight is usually only perception of light.

What is meant by extraction of cataract?

The removal of the opaque lens from the eye by some one of the various operations devised for the purpose.

What is discission of the lens?

In traumatic and soft cataracts occurring under thirty years of age, the anterior capsule and anterior lens substance are brought in contact with the aqueous humor by means of needle introduced through the cornea, which is used to divide the capsule. After

one or more of these operations the lens substance becomes absorbed. A similar operation is made after cataract extraction, when the lens capsule is opaque.

How is the simple or flap operation for cataract performed?

The eye is first thoroughly cleansed by the use of either boracic acid or bichloride of mercury solution dropped into the conjunctival sac. Then the lids are separated by the aid of a speculum, and the motion of the eyeball prevented by the aid of a pair of fixation forceps. The other instruments required for the operation are a Graefe or Beers cataract knife, a cystotome, a rubber spatula and spoon. An iris forceps and a pair of iris scissors should be at hand so that if it is advisable or necessary an iridectomy may be made. The cataract knife is pushed through the cornea at its horizontal diameter and a semicircular incision either upward or downward is made which involves nearly half of the cornea. The capsule of the lens is then freely lacerated with the cystotome. The margin of the lens nearest to the incision of the cornea is tilted upward until it presents in the pupil on pressure made at the opposite margin. The pressure is now increased and its direction somewhat changed so as to force the lens through the pupil and into the incision of the cornea, through which it finally passes and is removed, the eye closed and allowed to rest. All lens matter must be removed from the interior of the eye to insure a good result.

What is the modified linear or Graefe operation?

A narrow cataract knife is used, the points of puncture and counter puncture are made in the sclera and

the center of the incision at the sclero-corneal junction. When the incision is complete the iris is drawn out and a portion cut off. The capsule is lacerated and the lens removed from the eye by pressure in a manner similar to that of the simple operation. The iridectomy is often made some weeks before the extraction and is then called *preliminary iridectomy.*

What is the after-treatment of cataract extraction?

After the lens has been removed, the wound must be thoroughly cleansed, the iris pushed back into the eye if it is prolapsed, the lids gently closed and covered with bits of absorbent cotton, retained in position by a light bandage or adhesive plaster. The dressing is to be removed and the eye cleansed from day to day, and eserin or atropin used when indicated. The patient should be confined to bed in a darkened room for the first few days at least, and when the corneal wound has healed and no iritis has followed the operation, he may be allowed more light and liberty. When the eye is well, strong lenses are to be fitted and used to improve the vision.

What is aphakia?

Absence of the lens, which may in rare cases be congenital, but in the acquired form it usually results from cataract operations. It requires a strong convex glass for distant vision, depending upon the original refractive condition of the eye. As the power of accommodation is also lost with the removal of the lens, a stronger glass for near vision will be required.

What is luxatio lentis?

A dislocation of the lens, which may be congenital or result from an injury. In these cases the iris is tremulous, and with the ophthalmoscope the edge of the lens may be seen in the pupil, appearing as a dark curved line on the red background of the fundus. If the displacement is congenital, the lens remains clear, and operative interference is not indicated. The vision may sometimes be improved by convex glasses. When the lens is loose it acts as a foreign body.

Diseases of the Vitreous.

What is the vitreous body?

The vitreous body is a transparent, gelatinous mass, occupying the larger portion of the interior of the eye, through which the light passes to the retina. It gives support to the retina, and at its anterior portion is hollowed for the lens and its capsule to which it is adherent. The vitreous is enclosed throughout except in front by a thin, glassy membrane, the hyaloida. It has no blood-vessels in its structure in adult life, being dependent upon the vascular supply of the retina and choroid for its nutrition. It is composed of very fine fibrillæ, which enclose a gelatinous fluid in their meshes.

What changes occur in the vitreous from disease?

The vitreous becomes more fluid, loses its transparency or is filled with floating masses of cells or tissue which impair the vision or destroy it. Its relation to the choroid and retina is such as to cause it

to participate in or be affected by diseases of those tissues.

What is hyalitis?

An inflammation of the vitreous characterized by migration and proliferation of white blood corpuscles in the vitreous. Hyalitis may be serous, plastic or suppurative.

What are the causes of hyalitis?

Hyalitis may result from any disturbance in its nutrition, as from disease of contiguous structure, from blows, wounds of the more posterior portions of the globe, and the penetration and lodgment of foreign bodies in the eye.

What are the symptoms of hyalitis?

Any affection of the vitreous is known only by its effect in causing it to become turbid, thus impairing the vision. This turbidity results from the infiltration and proliferation of the cell elements, which may also form opaque, membranous masses. These may be either floating or stationary and if sufficiently large are readily seen with the ophthalmoscope in the direct method. In the suppurative variety there is pericorneal injection, inflammation of the iris and ciliary body, pain and formation of pus in the vitreous, with destruction of the eye.

What is the treatment of hyalitis?

The treatment should be directed to the cause, which is usually that of some inflammation of the choroid or retina. In the suppurative variety, the removal of the eyeball is necessary when the inflammation is due to

the presence of a foreign body. In some cases where the foreign body has passed through the eye or been removed from it, the suppurative inflammation has been controlled by Hepar sulphur.

What are opacities of the vitreous?

These may be small molecular opacities known as *muscæ volitantes*, due to opaque cells in the vitreous humor, usually insignificant, and occurring in debilitated conditions of the system, and often in myopia, or the opacities may be large and floating, the remnants of exudation or hemorrhages into the vitreous.

What is synchysis scintillans?

A condition in which the interior of the eye is filled with numerous floating crystals of tyrosin and cholestrin, which on ophthalmoscopic examination glisten or glitter like particles of gold and become kaleidoscopic upon movement of the eyeball. The vitreous is usually more fluid than normal.

What are the causes of vitreous opacities?

This condition may be due to any inflammatory condition, particularly syphilitic, of the interior structures, which causes a hypersecretion of serous fluid into the vitreous chamber. As the primary disease subsides, the vitreous may gradually clear and become transparent, or opacities of greater or less extent remain. When these opacities are floating or movable they indicate a fluid condition of the vitreous.

What is the treatment of vitreous opacities?

No special treatment beyond that directed to the cause of the disorder is ordinarily indicated, but such

remedies as Kali iodidum, Kali muriaticum, Hepar, Gelsemium, Phosphorus and Lachesis may prove useful in individual cases.

What parasites are sometimes found in the eye?

The cysticercus cellulosæ, more common in Europe, may be found beneath the retina or in the vitreous, or possibly in the anterior chamber. They appear as bluish-white cysts, which increase rapidly in size and induce inflammatory changes. The treatment consists in their removal if possible, and if not, enucleation of the eyeball.

What is persistent hyaloid artery?

A rare affection which results from the artery which is destined to supply nourishment to the lens during fœtal life remaining in extra-uterine life. It appears as a dark line extending from the posterior surface of the lens to the optic disc.

Diseases of the Retina.

What is the retina?

That tissue which forms the inner coat of the eye, supported in position by the vitreous, and which extends from the optic nerve entrance to the beginning of the ciliary body, where it ends in a serrated border, the *ora serrata.* The pigment layer together with some of its connective tissue elements are continued over the ciliary body and the posterior surface of the iris. The retina has histologically twelve layers composed of nerve fibres, ganglionic cells, connective

tissue, granular matter and special terminal organs for visual purposes, together with a layer of pigment in direct connection with the choroid. The terminal organs are the rods and cones which constitute the perceptive layer of the retina, and are arranged parallel to each other and perpendicular to the surface of the retina at its bottom. The rods are more numerous than the cones and the latter are alone found at the macula lutea, where, crowded together, they seem necessary for distinct visual impression.

What is the retinal purple?

A purplish coloring matter which is found in the outer layers of the retina, and which seems to be intended to destroy the effect of the luminous impressions received upon the retina after the stimulus has been transmitted to the optic nerve.

What is the macula lutea?

That portion of the retina which is situated a little below and to the temporal side of the optic disc, upon which the visual axis falls and which is considered the most distinct portion of the retina for visual impressions.

With the retina, upon what does the visual perception of an object depend?

Upon the power of the retina to convert the rays of light which fall upon it into nerve stimuli to be transmitted to the optic nerve.

What is the ophthalmoscopic appearance of the retina of the normal eye?

The retina being transparent in its normal condition, the ophthalmoscopic picture obtained in examina-

tion is virtually that of the choroid together with the distribution of the vessels of the retina. The color of the fundus as shown by the red reflex, varies with the complexion of the individual, being lighter in blonds than in brunettes. The blood-vessels branch from the optic disc on the temporal side in a somewhat curved course around the macula lutea, which thus appears devoid of a direct blood supply.

What are opaque optic nerve fibres?

The optic nerve fibres in passing through the lamina cribrosa, do not always leave their sheaths at this point, but from congenital defect are continued forward and form in the retina opaque masses, which are properly designated as opaque optic nerve fibres, and which should not be mistaken for exudations in the retina or choroid.

What is the indication of retinal disease?

When its structure, which is normally transparent, becomes opaque in any portion, as from a turgescence of its blood-vessels or a disturbance of the layer of pigment which overlies the choroid, it is significant of disease of the retina.

What are the indications of inflammation of the retina with the ophthalmoscope?

Hyperemia of the retina as well as that of the choroid, owing to the intimate association of these two tissues, is difficult to diagnose with the ophthalmoscope, as the only changes visible before inflammation are those found in a fine distinction between the circulation of the retina of one eye as compared with that of the

other. But when the condition is one of inflammation there is found a distinct picture of the lesion on ophthalmoscopic examination. The retina when inflamed exhibits opaque spots large or small, white or red in color, as the tissue change is due to exudation or hemorrhage within its structure.

How are the forms of retinitis designated?

By terms which indicate their cause, as retinitis albuminurica, retinitis leucemica, retinitis diabetica, retinitis syphilitica, retinitis hemorrhagica and retinitis idiopathica.

What is retinitis albuminurica?

An inflammation of the retina which presents so characteristic an ophthalmoscopic picture that from it alone a diagnosis of albuminuria can be made. Opaque spots and patches appear in the retina; when in the vicinity of the macula lutea they are arranged in radiating lines, but when near the optic disc in larger patches which encircle it and yet appear to be separated by healthy retinal tissue. While every form of kidney disease may present retinal changes, the atrophic or granular kidney presents more frequently the retinal complication. As the eye symptoms are only an expression of the kidney affection they require no special treatment.

What is retinitis leucemica?

When the blood corpuscles have lost their color from leucemia, the retina appears of a light yellow color instead of red, and this change of color of the fundus is termed retinitis leucemica and is indicative of the blood disease.

What is retinitis diabetica?

A rare complication of diabetes, characterized principally by minute or large hemorrhages in the retina.

What is retinitis syphilitica?

Syphilis furnishes one of the most frequent causes of retinitis, and when affecting the retina, retinitis syphilitica usually occurs during the third stage. It is exhibited in the retina by opaque plaques, or small dots, the latter often in the region of the macula, but the history and an examination of the urine are often necessary before a diagnosis can be made from the retinal changes.

What is retinitis hemorrhagica?

A form of retinitis in which, without other changes in its transparency, numerous spots of effused blood are visible in the structure of the retina. Such changes in the retina either indicate some disease of the retinal vessels or are associated with diseases of the kidneys or heart.

What is retinitis idiopathica?

All cases of retinitis which have no local cause or occur without any known cause are called idiopathic, but as a rule, during the progress of the retinitis the cause becomes apparent by the development of the disease in some other organ.

What is the treatment of retinitis?

The treatment is to be directed toward the organ or lesion which causes it. In general the protection of the eyes from strong lights, the avoidance of close work, and when necessary, the confinement of the individual

to a darkened room, with improvement of the general health and the use of such homeopathic remedies as Aurum, Belladonna, Bryonia, Gelsemium, Mercurius corrosivus, Kali iodidum, Phosphorus and Veratrum viride, which are indicated more frequently by their general indications than by the local changes in the eye.

What is retinitis pigmentosa?

An affection of the retina which appears to be more degenerative than inflammatory and involves particularly the pigment layer of the retina with subsequent atrophy of the retinal tissue. It is either congenital or inherent, and chronic in its course. Its most manifest symptom is the inability to see in a diminished light, as twilight, and presents the condition known as hemeralopia or night blindness. The changes in the retina are marked by the appearance in it of branch-like masses of pigment, which appear first at the outer portion or periphery of the retina and gradually advance toward its center. The field of vision becomes contracted until even its most central portion is obliterated.

What is the treatment of retinitis pigmentosa?

In the treatment, in addition to those measures designed to improve the general nutrition, the use of Agaricus, Nux vomica and Phosphorus may be found useful in limiting the disease.

What is anemia of the retina?

A very rare condition of the retina in which there is a lessened blood supply which temporarily impairs vision, and is due to weak action of the heart.

What is hyperesthesia of the retina?

A functional disturbance of the retina usually due to reflex causes arising in some other organ, as the uterus, and commonly present in hysterical subjects. It is characterized by intense photophobia and the absence of any perceptible lesion in the retina or optic nerve.

What are the symptoms of embolism of the central artery of the retina?

A sudden loss of vision, usually complete, with a partial recovery in some cases. The ophthalmoscopic examination shows usually some diminution in the calibre of the arteries of the retina and a hazy appearance of the macula lutea, with a bright red spot in its center.

What is detachment of the retina?

A separation of the retina from the choroid by effusion of blood or serum between these membranes. With the ophthalmoscope the retina appears raised in wavy folds and tremulous with the motions of the eye. The causes which produce it are either traumatism of the eye or diseases of the retina, choroid or vitreous. In high degrees of myopia, with posterior staphyloma, the danger of its occurrence is great.

What is the treatment of detachment of the retina?

When the detachment arises from injury in eyes that were healthy, reattachment may follow the confinement of the patient to bed and the application of a protective bandage to the eye. The use of Arnica and Hamamelis, which hasten the absorption of blood in traumatic cases, is of value. In idiopathic cases the

bandaging of the eye and the recumbent position of the patient is to be tried, together with the internal administration of Gelsemium and Aurum. The prognosis is unfavorable, although it depends greatly upon the extent of the traumatism or the diseased condition of the choroid, retina or vitreous which may have caused it.

What is glioma of the retina?

A neoplasm which has its origin either in the retina or optic nerve, and which is either congenital or developed during the first twelve years of life, and presents usually the only malignant tumor of the eye in children. It occurs between the ages of one and twelve years; it may, however, appear as early as the second month after birth. It is probably hereditary and dependent upon a cancerous dyscrasia.

What are the symptoms of glioma?

The earliest symptom is a yellowish-white or bluish-white appearance of the pupil, which on examination is found not to be due to changes in the pupil but to changes behind the lens. No pain nor redness is present, at first, and often the case is not brought for treatment until the eye becomes enlarged or pain and congestion of the sclera occur. As the tumor grows it advances into the interior of the eyeball, producing atrophy and detachment of the retina as it proceeds. With the ophthalmoscope it appears like a detachment of the retina. As the tumor increases in size all semblance of the eyeball is lost in the protruding mass which extrudes between the lids. It appears as a fleshy body secreting a sanious discharge and is subject to frequent hemorrhages in the advanced

stage of the disease, when it is called fungous hematodes.

What is the treatment for glioma?

Immediate removal of the eyeball, with as great a portion of the optic nerve as possible, is imperative when the tumor is confined to the interior of the eye. When it has extended beyond the confines of the globe, the question of operative interference is a grave one, as often the complete extirpation of the contents of the orbit affords only temporary relief, the sarcomatous mass under these circumstances seeming to acquire fresh energy from the operative measures.

Diseases of the Optic Nerve.

What are the optic nerves?

The optic nerves proper are those portions of the optic tracts which are in front of the chiasm. Each nerve is composed of about two-fifths of the tract of the same side and three-fifths of the inner portion of the optic tract of the opposite side. From the chiasm to their exit from the optic foramen they form what is known as the cranial portions. Their orbital portion is that from their exit at the foramen to their entrance into the eyeball at about four millimeters to the inner side of the posterior pole of the eye. The course of the nerve is that of a double curve so as to allow of the movements of the eyeball; its length is about one and one-eighth inches. The structure of the orbital portion consists of medullary nerve fibres, connective tissue and blood-

vessels which are in the sheath of the pia mater; in the orbit it is surrounded by two additional membranes which are continuations of the arachnoid and dura mater of the brain. At the entrance of the optic nerve into the eyeball it becomes reduced in size, the fibre bundles pass through the *lamina cribrosa*, a sieve-like membrane which covers the opening in the sclera, and as they pass this membrane they become denuded of their sheaths and enter the retina as naked axis cylinders.

In diseases of the optic nerve what is to be considered?

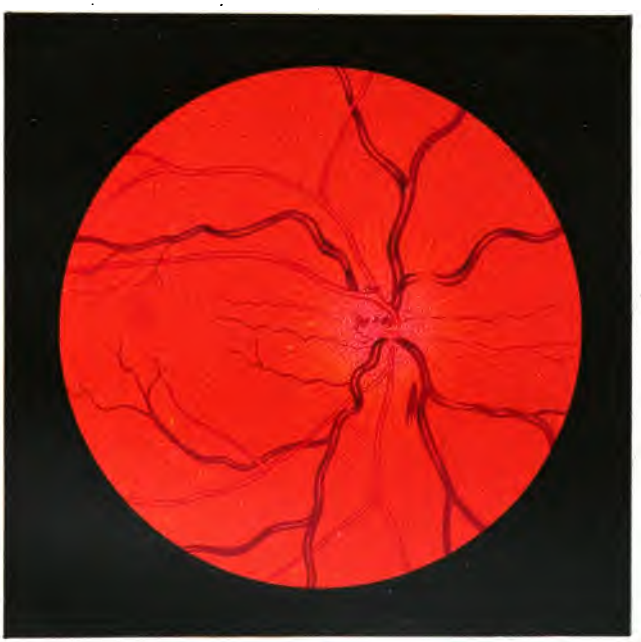
Its intimate relation with the brain by means of the continuation of the optic nerve in the optic tracts to their origin in the optic centers. The relation of the sheaths of the optic nerve to those of the brain, and the effect of increased pressure in the brain from circulatory disturbances or gross disease, as in the case of tumors or those finer changes in the cellular structure of the cortex which may disturb or destroy vision.

What is the function of the optic nerves?

To transmit impressions made upon the retina through the chiasm and optic tracts to the cortex of the brain, which result in a conscious perception of the retinal image.

What is the origin of the optic nerves?

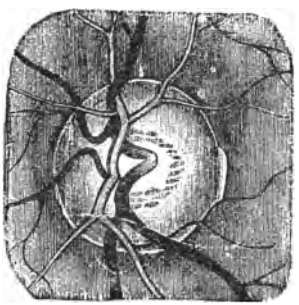
From the chiasm where they partially cross, they can be traced backward in the optic tracts on each side of the brain to those visual centers in the gray matter, the optic thalamus, the external geniculate body and the anterior tubercles of the corpora quadrigemina, and then to the cortex of the occipital lobe.



Optic Neuritis.

What is the optic disc or papilla?

After the optic nerve has passed through the lamina cribrosa on entering the eyeball, its fibres, as they are bunched together, form a slight elevation before they pass to the retina which presents a more or less round spot of white in an ophthalmoscopic examination called the optic disc or papilla. As this portion of the nerve



Appearance of the normal optic disc.

has no perceptive elements it forms a blind spot or scotoma in the field of vision. On the surface of the disc are to be found capillaries which, in its normal condition, give it a pinkish tinge, and also the branching of the retinal artery which has pierced the optic nerve some 20 mm. behind its entrance into the eyeball.

With the optic nerve, upon what does visual perception depend?

Upon the ability of the optic nerve to transmit the nerve stimulus to the brain from the retina through the optic tracts.

What is the function of the optic tracts?

To convey the impressions received from the optic nerves to their origin in the cortex of the brain.

What is optic neuritis?

An inflammation of the optic nerve, usually plastic in character, which may involve the nerve throughout its whole extent, but usually affects only that portion of the nerve which enters the eyeball; hence it is often called *papillitis*. When the inflammation is due to or accompanied by a distension of the nerve sheaths with fluid, the return of the blood through the retinal veins is interfered with and the neuritis is called *choked disc*.

How is optic neuritis diagnosed?

By the ophthalmoscope, the papilla appears woolly, swollen, and reddish in color. The retinal arteries are diminished in size, while the veins are enlarged and tortuous and both vessels are lost to sight at different portions of the disc by the edema which covers them. The edges of the disc are lost and a striated, grayish haziness covers the disc and extends out into the retina on all sides. Spots of effused blood scattered over the disc or even in the retina are not infrequently seen.

What is the condition of the vision?

During an acute attack of optic neuritis the sight may be but little impaired, but in the chronic forms the vision is apt to be more affected, and when atrophy occurs, the sight is rapidly lost.

What are the causes of optic neuritis?

Intracranial diseases are its most frequent causes; cerebral tumor is the most common, then meningitis and other inflammations, and abscess of the brain and cerebral softening follow with less frequency. Renal diseases, albuminuria and glycosuria, lead poisoning,

local lesions of the eye or orbit, syphilis, amenorrhea and other diseases also produce it.

What is the treatment of optic neuritis?

The treatment is to be directed to the removal of the cause. The eyes are to be protected from bright light by smoke-tinted glasses and all close use of the eyes suspended. Such remedies as Belladonna, Duboisia, Phosphorus, Nux vomica and Veratrum viride have proved useful in some cases.

What is retrobulbar neuritis?

A form of optic neuritis in which a portion of the optic nerve behind the globe is inflamed; the ophthalmoscopic appearances are slight redness and haziness of the disc in the early stage and a paleness of the temporal side later. The vision is impaired both for colors and white light, and more so in that part of the visual field opposite the macula lutea, thus presenting a central scotoma. It is usually of a chronic type.

What are the causes of retrobulbar neuritis?

It is usually dependent upon the toxic effects of tobacco, alcohol, opium and lead, but may result from systemic poisoning arising from other causes. The use of tobacco and alcohol in individuals who are susceptible to their toxic effects furnishes the largest number of cases, and as nicotin rather than alcohol is regarded as the prime factor, the condition of vision has received the designation of tobacco amblyopia, but as the loss of vision is due to the toxic effect of a drug, the general classification is that of *toxic amblyopia.*

What is necessary in the treatment of these cases?

To stop the use of or exposure to all poisons or drugs which may be a cause of the condition. The immediate improvement of the digestion and general nutrition. The local application of electricity and the prescription of Agaricus, Arsenicum, Nux vomica or Strychnia.

What are the ophthalmoscopic appearances of optic nerve atrophy?

The disc appears pale in color, sometimes bluish-gray or dead white. The capillaries have disappeared from the surface of the disc, while the large vessels of the retina may be reduced in size or remain unchanged for years. The disc usually appears smaller and more or less depressed, at its center may be seen the mottled appearance due to the lamina cribrosa. Where the atrophy has followed papillitis or retinitis there are usually some pigment patches in the vicinity of the disc.

What are the causes of optic nerve atrophy?

In addition to those causes which produce optic neuritis, spinal diseases, particularly locomotor ataxy, produce the largest number of cases. Embolism of the central artery of the retina, syphilis and menstrual disturbances also cause it.

What is meant by the terms primary, secondary, and consecutive atrophy?

Primary or simple atrophy is that condition in which symptoms of inflammation have not been visible. Secondary atrophy, when it is the result of some lesion of the optic nerves behind the eye, or of its fibres in

Atrophy of the optic nerve.

the brain. Consecutive, when the atrophy follows from inflammation of the retina or disc.

What is the condition of the vision?

The sight begins to be lost from the start, until total blindness results. The rate of progress may be rapid or very slow. The field of vision for both white light and colors is contracted concentrically with the macula, and the individual becomes also color-blind.

What is the treatment of optic nerve atrophy?

The prognosis is always unfavorable and treatment is often of no benefit. The application of the galvanic current to the eyes, the abstinence from alcohol and tobacco, and the use of Strychnia, Nux vomica and Agaricus have controlled the atrophy and saved the vision.

What is the principal tumor of the optic nerve?

Glioma, which is described as glioma of the retina. Fibroma, sarcoma and myxoma of the optic nerve have been reported.

What general diseases affect the eye?

Tubercular, strumous, syphilitic, gouty and rheumatic diatheses, with or without their general systemic disturbances often cause various eye diseases. The exanthemata particularly scarlatina, measles and variola produce both directly and indirectly many affections of the eyes. Typhoid, typhus and pneumonia not infrequently exhibit eye complications. Cerebro-spinal meningitis, meningitis, and cerebral and spinal affections present eye symptoms in which paralysis of

the muscles or optic neuritis is prominent. Diseases of the kidney, acute and chronic, produce not only inflammatory changes in the retina and optic nerve, but also affect the nutrition of the eye.

Diseases of the heart and blood produce changes in the choroid and retina which are often pathognomonic of these diseases.

Diseases of the sexual system and irritation of the genital organs in either sex, especially at the age of puberty, are very prone to cause disturbances and diseases of the eye. Dentition and diseases of the teeth often furnish causes for inflammation or irritation of the eyes.

Pertussis, malaria, fevers of all kinds, cholera and all diseases which lower the general vitality, may produce diseases of the eye which result directly from deficient nutrition of its tissues.

THE EAR.

ITS DISEASES AND TREATMENT.

General Anatomy and Physiology.

In the study of the diseases of the ear, it is necessary that the student should have a thorough knowledge of its anatomy and of the physiological appearance of the parts, in order that he may be able to determine the pathological variations. Excepting the eye, no organ of special sense presents such architectural beauty and intricate mechanism as that of the ear. From its location not far removed from that of the eye, and being also supplied by a nerve of special sense, whose function is to receive and transmit vibrations to the receptive portions of the brain, there exists a certain analogy of the ear to that of the eye in both its receptive, transmitting, and perceptive portions. The cornea receives and transmits the vibration of light-rays; the auricle receives and, with the aid of the auditory canal, transmits sonorous vibrations. The lens of the eye, in conjunction with the refractive media, change the rays of light so as to focus upon the retina, from which the impression made is conveyed by the optic nerve to the brain cortex, where perceptive vision occurs. The drum membrane of the ear analyzes the sound-

waves which fall upon it, and, through its intimate connection with the ossicles of the ear, transmits the vibratory impulses to the cochlea, where the sound-image is impressed upon the organ of Corti by which these vibrations are again analyzed, and the stimulus produced by the impression thus made upon the auditory nerve is carried by the latter to the auditory centers of the brain. With the eye, any destruction or impairment of the function of any of its receptive or transmitting portions results in impairment or loss of vision; while any defect of the receptive or transmitting portions of the ear results in impairment or loss of hearing.

What anatomical portions of the ear are of physiological importance?

The auricle or most external portion of the ear, which is intended for the reception and reflection of the sound vibrations; the external auditory meatus through which these sound-waves are conducted; the drumhead or drum membrane, which receives and transmits these vibrations through the chain of bony ossicles to those portions of the internal ear—the labyrinth, semicircular canals and cochlea—where the stimulus produced by the sound vibrations excites the terminal filaments of the auditory nerve in such a manner as to have this stimulus transmitted through the auditory nerve to the auditory area of the cortex of the brain.

Where is the auditory center of the brain situated?

In the temporo-sphenoidal portion of each side of the brain.

Describe the auricle.

The auricle is that portion of the hearing apparatus which stands out from either side of the head. It consists principally of cartilage and integument and is regionally divided into the helix, antihelix, concha, tragus, antitragus, lobule, fossa of the helix and fossa of the antihelix. Two sets of muscles, some of which

The auricle.

a, helix; *b*, fossa of the helix; *c*, antihelix; *d*, fossa of antihelix; *e*, tragus; *f*, antitragus; *h*, lobule; *g*, concha.

are primative, are attached to the auricle, the first set, connecting the auricle with the head, comprises the attollens, attrahens and retrahens aurem; the second set, found imbedded wholly within the auricle, are the helicis major and minor, tragicus, antitragicus, transversus and obliqueus auriculæ.

What are its congenital defects?

Deformities of shape and size varying from imperfect development to absence of the auricle, or only its

rudimentary indication as shown by the presence of a fistulous opening.

What is the lobule of the ear?

That pendulous portion of the ear consisting of fat and connective tissue with its integumentary covering which forms the inferior or lower part of the auricle.

What is the anatomy of the external auditory meatus?

This canal consists of a cartilaginous portion which is a continuation of the cartilage of the concha and tragus prolonged inward, but deficient in its upper and posterior part where there is a layer of fibrous membrane; and a bony portion, longer than the cartilaginous, terminating at the membrani tympani. The canal is lined with a continuation of the skin containing hair follicles and ceruminous glands. The incisuræ sartorini are two or three deep fissures found in the cartilage. Its direction is tortuous and enlarges toward the bony portion, where it narrows much, to again increase in calibre as it approaches the drum-membrane.

What congenital defects may be present?

The canal may be completely closed or absent, as is the common condition when the auricle is but rudimentary, or its channel may be lessened in size when there is an imperfect development of the auricle.

What is the drumhead or tympanic membrane?

The drumhead or tympanic membrane is, in its normal condition, the air-tight partition at the inner end of the auditory canal, and which separates the external from the middle ear. It is a thin elastic membrane more oval than round in shape, and of a pearl-gray

color, so placed as to form a long angle with the line of the roof of the auditory canal and a short angle with its floor. It thus forms the drumhead of the "drum" or cavity of the middle ear. The drumhead is about

Appearance of the right and left normal drumheads showing long handle of malleus and light spot.

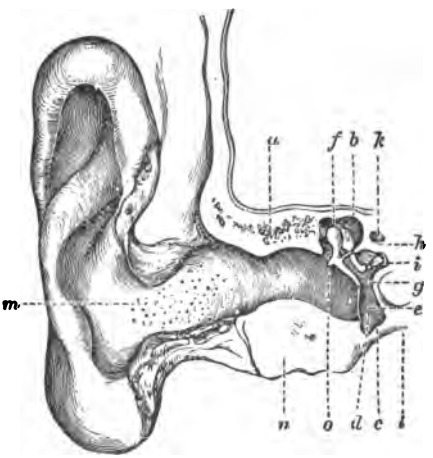
a quarter of an inch in diameter and about $\frac{1}{200}$ inch in thickness. It is composed of three layers, the outer or external layer being a continuation of the modified skin of the auditory canal, while the middle layer is a fibrous one with its fibres arranged both circularly and radially, and the third or internal layer is a membranous one continuous with that which lines the middle ear and the eustachian tube. The handle of the malleus forms a ridge running downward and backward to the center of the membrane, to which it is firmly attached, so that any movement of the drum-membrane is transmitted through the malleus to the chain of little bones of the middle ear. A cone or triangle of reflected light is to be observed with its apex at the tip of the handle and its base at the periphery of the drumhead in a downward and forward direction. At the upper portion of the handle of the malleus two folds of membrane pass from the handle of the malleus, one forward and the other backward. Above these folds is situated the membrane of Shrapnell or membrana flaccida.

What is the blood and nerve supply of the drum membrane?

The external layer is supplied by arterioles from the deep auricular branch of the internal maxillary artery and filaments from the superficial branch of the fifth nerve; the internal layer of mucous membrane is supplied by the tympanic branches of the internal maxillary, internal carotid and stylo-mastoid arteries and by the tympanic plexus of nerves.

What is meant by the "drum" or cavity of the tympanum?

The middle ear, an irregular wedge-shaped cavity in the petrous bone, measuring about half an inch



Vertical section of the external auditory canal, membrana tympani and tympanic cavity. Front View. (Politzer): *a*, upper osseous wall of external canal; *n*, lower osseous wall of canal; *b*, roof of tympanic cavity; *c*, floor of same; *d*, cavity of tympanum; *e*, membrana tympani; *f*, head of malleus; *g*, end of long handle of malleus; *h*, incus; *i*, stapes; *k*, fallopian canal; *l*, jugular fossa; *m*, location of ceruminous glands.

antero-posteriorly, one-third of an inch vertically and one-fifth of an inch transversely. It may be described

as having four walls, outer, inner, anterior and posterior, a roof and also a floor, which are lined with mucous membrane continuous with that of the throat. Its outer wall is formed by the tympanic membrane or drumhead; its inner wall is formed by the somewhat rounded projection of the cochlea, a portion of the internal ear showing on its upper portion, while below and backward the "oval window" or fenestra ovalis, which is closed by the foot-plate of the stapes, may be seen. Above the oval window is the projection formed by the aqueductus Fallopii for the transmission of the facial nerve. Below and posteriorly to the oval window lies the fenestra rotunda or round window, which is closed by the membrana tympani secundaria. Upon the inner wall, behind and a little below the oval window, a small pyramid is observed in which is found the origin of the stapedius muscle whose tendon is inserted into the head of the stapes. The anterior and posterior walls are formed by an excavation of the petrous portion of the temporal bone. The anterior wall is nearest the naso-pharynx and has in it the middle-ear opening of the eustachian tube. On its upper and inner portion there is a canal in which a minute muscle, the tensor tympani passes on its way across the tympanic cavity to be inserted into the handle of the malleus on its inner and upper portion. In the posterior wall, at its upper portion, is found the opening into the mastoid antrium and the mastoid cells, the roof being arched for the purpose of forming a location for the ossicles, and is separated from the brain by a thin partition of bone. The floor of the drum cavity is much smaller than its

roof, and separates the tympanic cavity from the jugular fossa and also presents an opening for the passage of Jacobson's nerve.

What are the ossicles of the ear and where is their location?

The ossicles are three small bones forming a chain connecting the tympanic membrane in front with the fenestra ovalis behind. The first bone, the malleus, has its long handle embedded in the tympanic membrane and articulates by its oval head with the incus or anvil, the middle bone of the series, which in turn articulates with the stapes or stirrup-bone, whose foot is connected by ligamentous fibres to the margin of the oval window of the internal ear.

By what are they enveloped in whole or in part?

By a prolongation of the mucous membrane from that of the drum cavity.

How are they supported in their position?

By small ligamentous bands to the roof of the middle ear and also by mucous membrane.

What muscles are found in the tympanic cavity?

The tensor tympani, laxator tympani major and minor, and stapedius muscles.

What blood-vessels and nerves are found in the tympanic cavity?

The tympanic branches of the internal maxillary, internal carotid, stylo-mastoid and petrosal arteries, and a branch from the ascending pharyngeal, which passes up the eustachian tube. Of the nerves, the tympanic branch of the glosso-pharyngeal (Jacobson's nerve), a branch of the facial nerve which supplies the

stapedius muscle, a branch from the otic ganglion to the tensor tympani muscle, and the chorda tympani nerve, a branch of the facial which passes through the tympanic cavity to join the lingual branch of the fifth nerve to the tongue.

What is the eustachian tube?

A cartilaginous and bony tube, about one and one-half inches in length, lined with mucous membrane and supplied with muscles for its dilatation. It begins with a trumpet-like opening in the upper part of the naso-pharynx, and passing upward, outward and backward, ends in a smaller opening upon the anterior wall of the tympanic cavity.

Where is its bony portion?

At its tympanic end. It is about half an inch in length, and a twelfth of an inch in diameter, and lined with mucous membrane which is closely connected with the periosteum covering the canal.

What is to be said of the cartilaginous portion?

It is about an inch in length, and is joined to the bony portion at the narrowest part of its opening called the isthmus. In its structure are found two cartilaginous plates, one triangular and one hook-shaped, both serving to prevent complete closure in this portion of the air canal formed by the eustachian tube for the purpose of supplying the middle ear with air, and which in its normal condition thus maintains the same atmospheric pressure behind the drum-membrane as that in front.

What muscles effect the dilatation of the tube?

The spheno-salpingo-staphylinus, circumflexus palati and tensor palati mollis.

What is the purpose of the dilatation of the tube?

That the middle ear cavity and the eustachian tube may be cleared of the mucoid secretion formed within them, by the action of the muscles of the tube which open its cartilaginous portion during the act of swallowing or other associated actions of the pharyngeal muscles.

What is the internal ear or labyrinth?

That portion of the organ of hearing lying beyond the middle ear which contains the osseous and membranous portions which form the essential structure intended for analyzing the sound vibrations which have been transmitted to it.

Of what does the osseous portion consist?

The vestibule, semi-circular canals and cochlea.

What is the vestibule?

The central chamber excavated in the petrous portion of the temporal bone and from which the channels of the semi-circular canals and cochlea diverge. The vestibule is ovoid in shape and from one-fifth to one-fourth of an inch in diameter. On its outer wall is the oval window, which is closed by the foot-plate of the stapes. Upon the inner wall are to be observed two depressions, the anterior one for the reception of the saccule and the posterior for the utricle. The posterior wall exhibits the five openings of the semicircular canals. The superior and posterior

canals have but one common opening. The anterior wall of the vestibule is replaced by the opening into the cochlea.

What are the semicircular canals?

The semicircular canals are three in number and so arranged that the plane of each one of the canals is perpendicular to that of the other two. They are called the superior, posterior and external canals, and extend in semi-circular shape from the vestibule back to it again. Just as the canals join the vestibule the opening is somewhat expanded, forming the ampulla. The cochlea is a bony tube which after making two and a half turns about an osseous axis, the modiolus, tapers to an apex and ends in a cul-de-sac. From the outer surface of the modiolus projects a thin, bony septum, the lamina spiralis, which partially divides the tube into two channels; the upper one, whose entrance into the vestibule occupies the place of its anterior wall, is called the scala vestibuli, while the lower channel, which communicates with the middle ear by the fenestra rotunda, is called the scala tympani.

What is the membranous labyrinth?

It consists of a series of tubes formed of connective tissue which partially fill the bony labyrinth. The semi-circular canals end in the utricle, a flattened elliptical tube which rests upon the inner wall of the vestibule. The membranous cochlea extends from the vestibule to the apex, where it ends in a blind pouch. These tubes, which only partially occupy the bony labyrinth, are filled with a clear fluid called the endo-

lymph, while the intervening spaces also contain a fluid, the perilymph.

What is noticeable about the utricle and saccule?

Upon the inner surface of these membranous sacs, near their attachment to the wall of the vestibule, there is on each a spot, known as the macula acustica, where the tissue of the membrane appears thickened, and to which a small branch of the auditory nerve is sent. There are still other spots similar to this in the ampullæ, near their opening into the utricle, called the cristæ acusticæ.

What are the otoliths?

Minute crystals of carbonate of lime which appear to be imbedded in a structureless mass upon the spots just described and between hair-like bodies called the auditory hairs.

Describe the membranous cochlea.

Beginning as a blind pouch in the vestibule and connected by a narrow canal to the saccule, it passes through the entire cochlea to the apex where it ends in another blind sac. By a membranous extension from the bony lamina spiralis it is divided into two spiral tubes, the upper one being called the scala vestibuli, the lower one the scala tympani, both filled with perilymph and extending to the apex of the cochlea, unite in the cupola; the opening of the scala vestibuli being closed by the membrane of the fenesta ovalis and that of the scala tympani by the foot plate of the stapes. A third spiral tube known as the ductus cochlearis, also filled with lymph, triangular on section, following

a spiral course, is found in the upper portion between the scala vestibuli and the outer wall of the cochlea closed at both ends and containing the organ of Corti, the essential portion of the internal ear, and which contains the peripheral termination of the auditory nerve.

What is the function of the scala vestibuli and scala tympani?

Principally to conduct the sound vibrations from the tympanic cavity to the endolymph of the ductus cochlearis.

How is the ductus cochlearis formed?

Its floor is formed by the membrana basilaris, its outer wall by the wall of the cochlea and its roof by the membrane of Reissner.

Describe the membranes basilaris and that of Reissner?

The membrana basilaris starts from the soft structure which is a continuation of the osseous lamina spiralis, and runs to the outer wall of the cochlea; it increases in width from the base of the cochlea to its apex as the lamina spiralis diminishes in the same direction. It is divided into two zones, an inner one called the habenula tecta, upon which lies Corti's organ, and an outer one, the zona pectinata. The membrane of Reissner runs from the edge of the lamina spiralis to the outer cochlear wall at a diverging angle from the basilar membrane. The triangular space thus formed by these membranes and the outer wall of the cochlea, forming the ductus cochlearis, is again divided by the membrana tectoria, which runs from the lamina spiralis

parallel with the membrana basilaris to the cochlea wall and separates the larger body of the endolymph from the organ of Corti.

What is the organ of Corti?

The terminal apparatus of the auditory nerve. It consists of rows of rods or pillars and tooth-like projections; the rods or pillars resting with their lower ends upon the basilar membrane, while their heads uniting with each other, form an arched roof. To the heads of these rods are attached plate-like processes. The organ of Corti extends along the basilar membrane from its beginning in the vestibule to its end in the apex of the cochlea. The rods or pillars, which are divided into an inner and outer row, between which the distance gradually increases as the organ of Corti extends from the vestibule to the cupola in the apex of the cochlea. On the outside of the arch formed by the heads and head-plates of these rods or pillars four rows of ciliated or hair-like cells are found. The inner row of these cells is nucleated and contains terminal filaments of the auditory nerve, which come from the cochlear portion of the nerve, and which, after entering the base of the osseous lamina spiralis, emerge from the bony, shelf-like projection of the latter in filaments which appear as a fringe and pass to the organ of Corti and to those cells, which are designated as the hearing or auditory hair cells. In addition to these are minute structures and structureless substances which are necessary for the support, control and cementing of these delicate structures which form the organ of Corti.

How many rods are there in the organ of Corti?

Some six thousand in the inner row and forty-five hundred in the outer row, while the arches which they form are estimated at three thousand or more.

What is the distribution of the auditory nerve in the labyrinth?

The auditory nerve, after passing through the internal auditory canal which is formed for its passage through the central portion of the temporal bone, divides into two branches: First, a vestibular branch, which, after passing through a ganglionic swelling divides into three branches, which reach the utricle, the ampulla of the semi-circular canals and the saccule, and are found distributed upon their maculæ or spots. Second, a cochlear branch, the most important and larger division, passes to the center of the lamina spiralis of the cochlea to be distributed in the organ of Corti.

Where is the origin of the auditory nerve?

The auditory nerve, the portio mollis of the seventh cranial nerve, arises from two roots in the medulla oblongata; one having origin in a ganglionic nucleus in the floor of the fourth ventricle, and the other in the crus cerebelli and medulla. It receives fibres from the gray matter of the cerebellum and after winding around the restiform body passes forward and enters the internal auditory meatus together with the portio dura or facial. At the bottom of the meatus it divides into vestibular and cochlear branches.

What is the mastoid?

The mastoid is that process of the temporal bone

immediately behind the auricle composed of a large number of irregular cells of various sizes, encased in a dense cortical layer of bone. In the upper part of the process is a large cell called the mastoid antrum, which communicates with the tympanic cavity, and also with the lower cells. The cells being lined with a thin mucous membrane continuous with that of the middle ear, are susceptible to the diseases of the middle ear.

What is sound?

The sensation produced upon the auditory nerve filaments by the vibrations of a sonorous body.

What is necessary for the perception of sound?

That the vibrations be transmitted to a normal organ of hearing so that a proper impression is made upon the auditory centers through the auditory nerve.

What is a noise?

When the vibrations or sound-waves are repeated irregularly, or when the interval between the impulses is of considerable length, the impression produced upon the ear is called a noise.

What is understood by tone?

When the vibrations are regular and even, the sound produced is a musical one and known as a tone; the pitch of the tone depends upon the rapidity of the vibrations.

What are the highest and lowest tones perceived by the human ear?

That produced by thirty-two thousand five hundred double vibrations per second forms the limit of the high tones, and those of sixteen per second furnish the lowest limit of the range.

Methods of Examination of the Ear.

First, the history of any disease or injury and subjective symptoms which may have a bearing upon the subsequent diagnosis, prognosis or treatment of any abnormal condition, having been learned, then, in addition to the inspection of the auricle, the auditory canal, the condition of the drum membrane and that of the eustachian tube, with an inspection of the nasal and pharyngeal membranes which are continuous with its pharyngeal opening, it is necessary that the power of hearing be estimated by some standard test.

For the examination of the ear and for testing the hearing power, what is necessary?

First, a good light of sufficient intensity to illuminate the more external portions of the ear; second, an aural speculum of proper size and shape with which to straighten the auditory canal; third, a circular mirror, preferably concave, with which to reflect the light into the canal and illuminate the walls of the canal and the drum membrane, or in its absence the tympanic cavity; fourth, the use of the voice or some mechanical sound-producing instrument, with which to test the hearing power; fifth, such instruments as the nasal speculum, rhinoscope, and possibly the laryngoscope, and the air-bag of Politzer, or the eustachian catheter; the latter two instruments being designed to aid, with the rhinoscope, in diagnosing the condition of the eustachian tube.

What may be considered a good light for the examination of the ear?

Any white light, natural or artificial, of sufficient

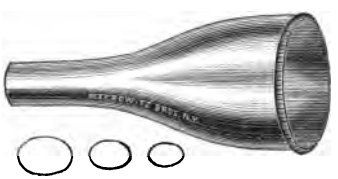
intensity, which, when reflected by the mirror or otoscope, gives a perfect illumination of the parts under examination.

What is an aural speculum?

A funnel-shaped instrument made of glass, rubber or metal, which, when introduced into the auditory canal, both straightens and dilates its more exterior portions.

What is an otoscopic mirror?

A plane or concave mirror, usually from $2\frac{1}{2}$ to $3\frac{1}{2}$ inches in diameter, affixed to the forehead by a head-



Gruber's aural speculum.

band or adjusted to a handle, and which is intended to reflect, by proper manipulation, the light-rays from the source of illumination through the speculum into the deeper portions of the ear.

What is necessary for the examination of the function and test of the hearing?

Either the use of the human voice or such sounds as are produced by the aid of mechanical instruments for this purpose.

How is the hearing power determined by the use of the voice?

The patient having closed his eyes and stopped the ear not under examination with the finger or a bit of

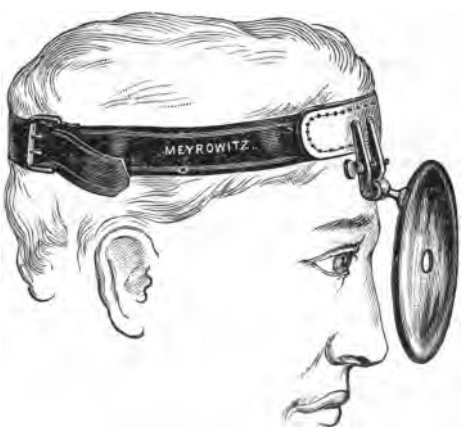
cotton, is directed to repeat words spoken in ordinary tones or in whispers, and the greatest distance at which the voice-sounds are heard is noted in feet or inches, to be compared with the distance at which such sounds are heard by an ear of normal hearing.

What mechanical devices are used in testing the hearing?

An ordinary loud-ticking watch and tuning forks of standard pitch.

How is the watch used?

A loud-ticking watch whose movement can be stopped without exciting the interest or suspicion of



Otoscopic mirror with headband.

the patient is brought from a distance within the limit of the hearing distance for the normal ear and in a direct line with the ear under examination, the opposite ear being closed by the application of the finger. The watch is now slowly carried in a direct line with the

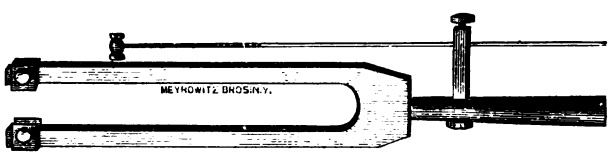
ear until its "ticks" are distinctly heard by the patient, and the distance in feet or inches at which it is heard is noted. When it must be brought in direct contact, or pressed against the ear to be heard, or when it is only heard when in contact with the mastoid region, the hearing power is recorded accordingly as "watch contact," "watch pressure," "watch mastoid."

Of what value is the tuning fork in testing the hearing?

It enables the observer to determine whether the loss of hearing which may be present is due to affections of the nervous or conducting portions of the ear.

How is the tuning fork test applied?

By first putting it into vibration and then placing its handle upon the center of the forehead, or upon the



Blake's tuning-fork.

front teeth of the upper jaw, in such a manner so as not to interfere with its vibrations, and then asking the patient in which ear the musical tone is heard the louder. The sound in this test is conveyed through the bones of the skull to the auditory apparatus, and the sound seems louder in that ear in which there is some obstruction in the more external portions of the ear due to mechanical or disease causes.

What other methods are employed in testing the hearing?

Those as devised by many individual observers in

which tuning forks and whistles of various pitch are used for the purpose of determining the hearing defect or diagnosing that portion of the hearing apparatus which may present an impaired function.

Why is it necessary to use such instruments as a nasal speculum, a rhinoscopic or laryngoscopic mirror in connection with the examination of the ear?

Because the condition of the nose, pharynx and throat may have much weight in making a diagnosis of the ear affection. Without their employment it is often impossible to determine with proper accuracy the true condition.

Of what use is the rhinoscopic mirror?

Is enables us, when properly used, to determine the normal or pathological condition of the mucous membrane in and around the opening of the eustachian tube.

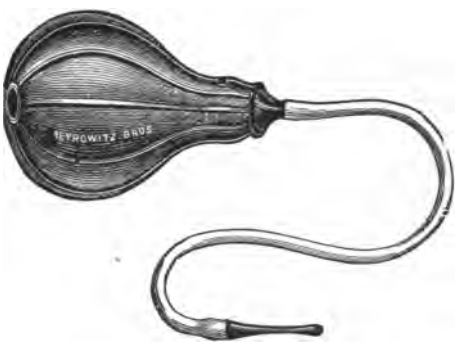
Of what use is the Politzer air-bag and the eustachian catheter in the examination of the ear?

We are enabled by their use to determine whether the eustachian tube in its passage from the throat to the tympanic cavity is open or closed.

How is the air-bag used for this purpose?

The nozzle of the air-bag is placed in one nostril, the other being closed by the finger of the operator; the patient is directed to swallow a sip of water given him or to blow through the partially closed lips or utter certain sounds or words at the direction of the operator, while the latter compresses the air-bag and thus fills the air cavities of the nose so that the air is forced into the eustachian tube by the closure of the

naso-pharynx, from the muscular contraction of the soft palate and by the associated dilatation of the eustachian tube in the effort to swallow, blow, or utter the sounds as directed.



Air-bag for inflating middle ear.

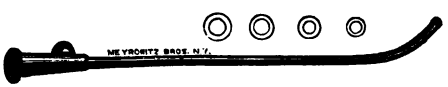
What is the eustachian catheter?

It is a catheter-shaped instrument, preferably of hard rubber, having a funnel-shaped opening and also a metallic ring near the end of its handle; the ring indicates the direction of its point.

How is the eustachian catheter used?

The side of the nostril in which it is to be introduced having been cleansed of any accumulated secretion, and the sensibility of the mucous membrane being partially deadened by the use of a four per cent. solution cocain applied by a swab along the floor of the nose, the handle of the catheter is held gently between the thumb and fingers of the hand, while the nares are illuminated by reflected light from a head mirror. The point of the catheter is now introduced into the nostril

so that its point touches the floor of the nose, and is then gently pushed backward until it has passed over the soft palate or touches the naso-pharynx; it is then gently rotated until its point is directed into the eustachian opening. A rubber tube of small size, with a rubber, ivory or bone piece, is adjusted by one end to the auditory canal of the patient and by the other end to that of the operator; an air-bag with a hard rubber tube of proper size to fit the opening in the handle of the catheter is now compressed, and if the catheter is applied properly to the opening of the eustachian tube the air from the bag passes through the tube into the



Eustachian catheter. (One-half size.)

middle ear, if the tube is pervious. If the tube is open certain sounds are transmitted from the ear of the patient by means of the diagnostic tube which enable him to determine the condition as well as the presence of secretion in the eustachian tube or in the tympanic cavity.

What other method is sometimes employed to determine the patency of the eustachian tube?

That known as Valsalva's method.

How is Valsalva's method accomplished?

By forced expiration, the mouth and nasal passages being closed; if the eustachian tube is open, the air passes up into the ear and distends the drum-membrane.

Wounds and Injuries of the Ear.

What are the more common wounds and injuries of the auricle?

Incised, punctured, lacerated and contused wounds and those injuries resulting from chemical agents or intense heat or cold.

How are wounds of the auricle to be treated?

As similar wounds in other portions of the body, except that all necessary sutures should be inserted on the posterior portion of the auricle to prevent the disfigurement which would appear from their use upon its anterior aspect. Contused wounds of the auricle are not uncommon, and require no special treatment, unless the injury results in the effusion of a large amount of blood from fracture of the cartilage; when this occurs, the use of ice-cold applications is indicated to prevent, as far as possible, the advent of acute perichondritis.

What is the treatment of burns of the ear?

Burns of the auricle, the meatus and even the mastoid are to be treated on general surgical principles and the fact borne in mind that inflammation of the middle ear may result from such injuries.

What is to be done for frozen or frosted ears?

The parts are to be restored gradually to their normal temperature, by the use of ice or snow, then of cold water, the temperature being slowly increased until the parts have recovered their normal temperature. Sometimes the traumatism thus produced is followed by a perichondritis or even necrosis of some portions of the auricle.

What injuries may involve the meatus?

A fracture of the osseous meatus may occur when, from a fall or blow upon the lower jaw, the condyle is driven backwards, or in some cases of injuries affecting the head, when the drum-membrane may also be ruptured. Fractures of the meatus are generally complicated by fissure of the upper or inner tympanic wall, fracture of the mastoid process, petrous portion of the temporal bone or fracture of the base of the skull.

What is the treatment?

If the meatus only is involved no treatment beyond the application of common surgical principles is required.

In what other way may injury to the meatus be produced?

By unskillful use of instruments in the endeavor to extract foreign bodies.

What may be said of injuries to the internal ear?

Such injuries usually result from fractures of the base of the skull or concussion of the labyrinth or of the auditory centers; rupture of the tympanic membrane may also take place, as from the shock of a blow on the ear, sudden loud sounds, as the report of fire-arms, an engine-whistle, etc. Deafness or impairment of hearing, tinnitus, giddiness, or even faintness, are frequent results from such injuries. Effusion of blood within the internal ear may occur from some forms of fracture of the bones of the head. Symptoms will thus depend upon the nature and location of the lesion produced by the injury. Direct injury to the labyrinth may occur as a result of rough attempts to extract a foreign body.

What are the indications for treatment?

Restoration of the parts as far as possible, in a surgical sense, to their normal condition, and the improvement of any impairment of hearing.

From what does rupture or perforation of the drumhead or tympanic membrane occur?

From penetration of foreign bodies, as twigs of trees or the introduction of knitting-needles, penholders and the like into the meatus; sudden changes in atmospheric tension in ears already diseased, as in boxing the ears, explosions, diving, or working in caissons under increased atmospheric pressure.

What is the treatment of rupture of the drumhead?

The meatus should be plugged with cotton wool, while rest, low diet, abstinence from alcohol and tobacco and avoidance of cold and exposure are enjoined. Under this treatment, not permitting the ear to be syringed or in any way interfered with, the perforation usually heals with great rapidity. Should pain occur, cold compresses and the indicated remedy will be of service.

General Considerations of Treatment.

In the treatment of the ear the general health must be taken into consideration, as, when impaired, it not only predisposes to aural affections, but seriously impedes the progress of cure. In the chronic forms of deafness, particularly those arising from catarrhal conditions of the middle ear, the resort to a more dry

atmosphere should receive full consideration. In the treatment of the local condition great progress has been made in the intelligent application of the various local measures employed in the treatment of ear diseases, so that the results obtained are much more satisfactory than formerly.

When is protection of the ears necessary?

When from disease the drum-membrane becomes over-sensitive to cold air, or when the drumhead has been perforated or destroyed, it is advisable to insert a small pledget of cotton into the canal.

How should heat and cold be applied to the ear?

Heat by means of hot flannel, bags of hot bran or salt, and the hot-water bag is to be applied directly to the auricle. Cold is rarely indicated in the treatment of ear diseases, but when so, it is best applied over the ear by means of an ice-bag.

How is the ear to be cleansed?

Usually by means of absorbent cotton upon a cotton carrier introduced into the canal under a good light and repeated until all discharge has been removed. When it is deemed advisable to employ the syringe, the stream of water should be injected with care and the canal afterward thoroughly dried with absorbent cotton.

How are lotions employed in the ear?

All lotions should be warmed before use, and then either applied by means of absorbent cotton on a carrier or dropped into the external canal by means of a pipette. In introducing poisons into the ear it is

necessary to remember that if a perforation of the drumhead exists, toxic effects may occur by the fluid reaching the throat.

How are powders introduced into the ear?

When indicated, they should be blown gently into the canal or middle ear by means of a powder-blower, care being taken not to pack the canal too full.

How are caustics applied in the treatment of the ear?

In cases where it is desired to remove granulation tissue, or small polypi, and a caustic is indicated, its application should be made to the part alone by means of the cotton carrier. Caustics in solution should never be dropped into the ear.

How are poultices to be used?

When applications of moist heat are desired, the safest manner of poulticing the ear is to drop warm water from a pipette directly into the canal at frequent intervals. Small conical pledgets of absorbent cotton frequently dipped in hot water and inserted into the canal, form a very satisfactory method of poulticing. Large poultices are rarely if ever indicated in inflammation of the canal or middle ear, as their use tends to cause an extension of a suppurative process. In inflammation of the mastoid a poultice sufficiently large to cover the parts immediately behind the ear is indicated.

Diseases of the External Ear.

What congenital malformations of the ear are found?

The auricle may be rudimentary or absent on one or both sides; the external auditory meatus may also be absent or closed by a fold of skin. If the auricle is not developed, there is usually a corresponding non-development of the auditory meatus and defects in the middle ear, so that any surgical operation which might seem indicated for the pupose of opening the canal is usually of no value. Congenital malformations of the drum membrane, or of the middle and internal ear are rare but do occur.

What are the principal diseases of the auricle?

Eczema, perichondritis and othematoma.

What is eczema of the auricle?

A cutaneous disease of the auricle which may be acute or chronic. The acute variety is characterized by redness, swelling, itching and burning of the skin, followed by an eruption of vesicles which rupture and give rise to thick yellowish crusts. In the chronic form the skin becomes thickened, covered with dry scales, and is accompanied by much itching of the part.

What are the causes of eczema of the auricle?

Either a gouty or rheumatic diathesis, intemperance in eating and drinking, and other causes which lower the general vitality.

What is the treatment of eczema of the auricle?

This consists in the removal of any local exciting cause and the relief of any constitutional element which may induce the disease. Local applications are

frequently used but are of doubtful value. The use of Arsenicum, Graphites, Mezereum or Sulphur is usually prompt in curing this condition.

What is perichondritis?

An inflammation of the cartilaginous framework of the ear, arising usually from injury and occasionally idiopathically. It may involve the whole or only a small portion of the cartilage.

What are the symptoms of perichondritis?

There is usually a feeling of heat in the external ear, followed by severe pain. The auricle increases rapidly in size and the skin over the site of the inflammation becomes bright red in color. As the disease advances, effusion of serum takes place beneath the perichondrium which changes the appearance of the ear and destroys its normal outline. The fluid soon becomes purulent and often evacuates itself.

What is the treatment of perichondritis?

When arising from traumatic causes the application of cold by means of an ice-bag should be made immediately, and may prevent or control the effusion. The fluid may be removed by a free incision or aspiration. Arnica, Belladonna, Arsenicum and Mercurius are to be considered in the treatment. The deformity of the auricle which follows this disease is irremediable.

What is othematoma?

It is a blood tumor of the auricle occurring in the insane and is probably a trophic lesion. It consists of the effusion of a sanguinous fluid beneath the perichondrium and is rarely amenable to treatment. Deformity of the auricle follows it.

What other tumors may develop in the auricle?

Enchondromata, Cystomata, Fibromata, Sarcomata and Epitheliomata; all occur with comparative rarity. Sarcoma of the auricle is extremely rare.

What are the principal affections of the external auditory meatus?

Acute circumscribed external otitis, diffuse external otitis, impacted cerumen, foreign bodies in the canal and exostosis.

What is acute circumscribed external otitis?

A circumscribed inflammation of the external auditory meatus, which arises either from mechanical irritation of the walls of the canal or is due to some local infection by pathological bacteria. It is a frequent accompaniment of low conditions of the general health.

What are the symptoms of circumscribed external otitis or furuncle of the external auditory canal?

There is pain, swelling and redness of that portion of the canal affected. The pain, as a rule, is more severe the nearer the furuncle forms to the middle ear; the swelling and redness are variable, both often involve the whole extent of the canal.

What is the treatment of furuncle of the canal?

The local use of such means as may relieve the pain, and the internal administration of such remedies as will control or hasten the suppurative process and remove the tendency to a recurrence of the inflammation. The local applications of small pledgets of absorbent cotton dipped in hot water and applied to the canal are often soothing. The instillation of Magendie's solution of sulphate of morphia, when there

is no perforation of the drumhead, lessens the severity of the pain. When the furuncle matures, an incision may hasten the reparative process. The use of Arsenicum, Belladonna, Hepar sulphur, Mercurius, Calcarea picrata or Sulphur is usually indicated.

What is diffuse otitis externa?

An inflammation of the skin lining the external auditory meatus. All the symptoms of a dermititis are present; the pain being more severe when the inflammation attacks the inner portion of the canal. The walls of the canal are red and swollen and there is usually some discharge, sebaceous or purulent in character.

What are the causes of diffuse otitis externa?

It results frequently from irritation of the skin of the canal by the introduction of instruments, foreign bodies, or chemical and thermal irritants into the canal. It commonly occurs as a result of middle ear diseases from the discharge which comes through the perforated drumhead. It also arises by extension from diseases of the auricle and from direct septic infection.

What is the treatment of diffuse inflammation of the external auditory canal?

This consists in a thorough cleansing of the canal with boracic acid, bichloride of mercury, or nitrate of silver in moderate solutions, together with a correction of the diseased condition of the auricle which causes it, or the cure of the middle ear discharge when present, and also the internal use of such remedies as Arsenicum, Belladonna, Graphites and Mercurius.

What is impacted cerumen?

A filling of the external auditory canal with cerumen, which dries into a hard mass and finally causes pressure upon the drumhead. Its common causes are mechanical irritation of the walls of the canal and catarrhal affections of the throat and middle ear.

What are the symptoms of impacted cerumen?

Sudden impairment of the hearing, tinnitus aurium, vertigo and pain; the latter is not always present. The examination of the canal shows it to be filled with a dark brown mass of ear-wax which prevents any view of the tympanic membrane.

What is the treatment of impacted cerumen?

This consists in the use of fluid vaseline, or bicarbonate of soda solution dropped into the canal a few times to soften the mass so that it may be removed by the use of the aural syringe and warm water which usually restores the hearing and relieves the tinnitus and vertigo. The canal and drumhead often present a congested appearance which rapidly subsides after the canal has been cleared. It is well to protect the parts from atmospheric changes by wearing for a few hours a pledget of cotton in the canal. If the causes which produced the hypersecretion are not removed a recurrence of the trouble is to be expected.

What foreign bodies are found in external auditory canal?

Foreign bodies of all descriptions whose sizes do not exceed the calibre of the canal may be found from time to time in various portions of the external auditory meatus. Insects and larvæ may be found in the

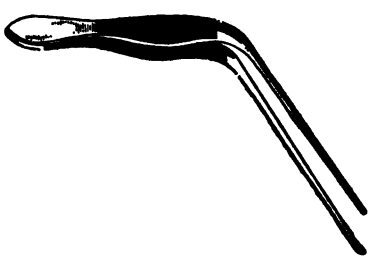
canal. Fungous growths such as the aspergillus are also found in this portion of the ear.

What are the dangers of foreign bodies in the canal?

When not impacted they may remain in the canal without causing any serious inconvenience or trouble. The greatest danger arising from their presence in the canal, is the injury and subsequent inflammation which follows unskillful efforts applied for their removal.

How are foreign bodies to be removed?

When their presence, character and location have been determined by an examination of the canal with a speculum, and under a good light, the use of the



Foreign-body forceps.

aural syringe for the injection of water into the canal is both safe and efficient. The use of the syringe is always indicated before any other method, unless the foreign bodies are small and can be easily reached and removed with a pair of foreign-body forceps. If the syringe fails to dislodge the foreign body owing to its impaction, it then becomes necessary to attempt its removal by instruments in the hands of those skilled in their use. If the walls of the canal have become

swollen from the efforts to remove the foreign body, it is often better to reduce the inflammation before attempting anything further.

What is aspergillus, and what is its treatment?

It is a fungus, of which there are several varieties, which develops in the auditory canal. It is usually found mixed with cerumen and epidermal scales. It causes considerable itching of the ear, and there is usually a sensation of fullness, with diminished hearing, and often a reflex cough. The treatment consists in the thorough removal of the mass with the syringe and the application of proof spirits, or a five per cent. solution of nitrate of silver, to the walls of the canal.

What is aural cough?

A reflex cough produced by an irritation of the walls of the external auditory meatus from foreign bodies, fungi, or inflammation. In all cases of cough, when persistent, even when apparently explainable, it is well to examine the external meatus for a possible cause.

What is exostosis of the external auditory canal?

A term applied to osseous growths which develop in the canal. The causes which produce them are still in doubt. When small and pedunculated they may be removed; when situated in the deeper parts of the canal, operative treatment is not warranted; when filling the canal, an opening may be made through them with a dental drill.

Diseases of the Middle Ear.

What are the diseases of the middle ear?

Acute catarrhal otitis media, acute purulent otitis media, chronic catarrhal otitis media, and chronic purulent otitis media.

What is acute catarrhal otitis media?

An inflammatory affection of the middle ear resulting in an increase of the normal secretion.

What are the causes of acute catarrhal otitis media?

The causes which are active in the production of this disease are principally those which occasion a venous or circulatory stasis within the mucous membranes of the middle ear. It may complicate measles and other exanthemata, a cold in the head, or may be caused by the introduction of fluids through the eustachian tube while bathing or through the use of the nasal douche. Abnormal conditions of the upper air passages, particularly an enlarged pharyngeal tonsil, predispose to this disease, and it frequently occurs directly from exposure to cold and wet. In infancy, the irritation incident to the eruption of the teeth often causes it.

What are the symptoms of acute catarrh of the middle ear?

The symptoms vary considerably, but usually there is a feeling of fullness and stuffiness in the ear dependent upon occlusion of the eustachian canal, which is soon followed by noises and pain, steadily increasing in severity, usually distinctly localized and referred to the tympanic cavity, and aggravated upon lying down. Each act of deglutition is painful and often causes an

Normal Tympanic Membrane.

Congestion of Tympanic Membrane.

Perforation of Tympanic Membrane.

Retraction of Tympanic Membrane.

entrance of air into the tympanum with bubbling sounds. The pain subsides gradually when the stage of hypersecretion is passed, or abruptly if spontaneous rupture of the membrana tympani occurs, which may take place in from 12 to 48 hours, to be followed by a muco-serous discharge in the external auditory meatus. The objective symptoms are injection and bulging of the membrane, naso-pharyngeal catarrh and often some febrile disturbance.

What is the treatment of acute catarrhal otitis media?

This consists in the frequent application of dry heat to the ear and side of the head, or warm water dropped into the ear, drop by drop as warm as can be tolerated. A few drops of aconite, belladonna or plantago added to the water increase the effect of the application and tend to relieve the pain. As soon as practicable the air-bag should be used to gently inflate the middle ear, the opening of the eustachian tube being often followed by relief of all the symptoms. Paracentesis of the membrana tympani may be necessary in some cases, but is not often indicated.

What are the indications for remedies?

Belladonna.—Pain is shooting, beating, darting; marked chilliness and great restlessness. *Chamomilla:* Particularly in children, great intolerance of the least pain. *Gelsemium:* Apathetic, quiet condition, fever not marked, patients inclined to stupor, head symptoms of pressure and tension relieved by outward pressure or binding. *Pulsatilla:* Especially in women and children or persons of extremely sensitive nature. Amelioration in open air. *Hepar sulphur* will often ward off

suppuration, when the patient is extremely sensitive to air and to touch, and is relieved by wrapping and by warm, dry applications. *Mercurius:* Excessive perspirations of a sticky or greasy nature which do not relieve the general suffering, but annoy the patient. Tenderness down the neck beside the jaws with dull, boring pain in the ear.

What is acute purulent otitis media?

An acute inflammation of the middle ear attended with suppuration and destruction of tissue.

What are the causes of acute purulent otitis media?

The most common cause is some acute infectious disease as scarlatina, measles or diphtheria. Traumatic injury of the membrana tympani, chronic tonsillitis and dentition are frequently productive of this form of middle ear inflammation and occasionally it follows acute catarrhal otitis media when the inflammation from some cause becomes more intense and the catarrhal secretion becomes purulent.

What are the symptoms of acute purulent otitis media?

The characteristic symptom of acute purulent otitis media is sudden and excruciating pain deep within the ear. Attending this there is a decided elevation of temperature, severe headache, constipation and a marked constitutional depression. The hearing becomes rapidly impaired, there is often distressing tinnitus and in some cases vertigo, In children the attack is frequently ushered in with convulsions. Delirium may be present. When perforation takes place there occurs a rapid alleviation of the pain, tinnitus and deafness,

and the purulent secretion is discharged through the ruptured drumhead into the external canal. Changes in the membrana tympani, such as loss of translucency, thickness, loss of the light spot, intense congestion of the drumhead in the early stages, then moisture or a sodden condition are readily observed and the membrane bulges forward from the pressure of the purulent matter behind it. Extensive destruction of the structures of the middle ear occurs in some cases and the inflammatory process may extend and the mastoid become affected. The membrana tympani is not always ruptured, the pus finding exit through the opening of the eustachian tube, when it passes to the throat, or forward through the skin to find an opening externally or infiltrates the mastoid cells or breaks through into the cranial cavity.

What is the treatment of acute purulent otitis media?

In the early stages the treatment is essentially that of acute catarrhal otitis media. If the inflammatory action is not relieved by medication and if the membrana tympani bulges but does not tend to rupture spontaneously, paracentesis will not only give relief to the intensity of the pain, but often leaves the tissue in a more favorable condition for repair, and may also prevent the extension of the purulent inflammation to other parts.

What are the indications for the commonly used remedies in acute purulent otitis media?

Aconite, indicated in high fever, burning skin, great restlessness and thirst. *Belladonna*, less marked redness and heat of surface, less restlessness, but mentally

a desire to escape. *Chamomilla* is characterized by the intolerance of pain on the part of adults, or extreme irritability and peevishness of children. *Capsicum* is of value for adults when the mastoid process is threatened by the inflammatory action. *Dulcamara* and *Gelsemium* are of more value in acting against threatening suppuration than when it is fully established. *Hepar sulphur* has the local tenderness about the ear, with relief from wrapping. *Mercurius*, when there is dull, boring pain in the ear, with much general perspiration, and particularly after rupture of the drumhead, when there is a tendency to the development of granulation tissue. *Pulsatilla*, valuable in the early stages, especially in children. *Tellurium* is indicated in cases where perforation has occurred, with extensive destruction of the tissue of the drum membrane; the discharge is usually of an ichorous, excoriating and especially fetid nature.

What is chronic catarrhal otitis media?

This is a chronic, non-suppurative inflammation of the mucous membrane and submucous tissues of the middle ear, producing deafness, tinnitus, and sometimes vertigo and other symptoms of deranged auditory functions. It is also known as moist and dry catarrh, and as hypertrophic, atrophic, catarrhal and proliferous inflammation of the middle ear.

What are the causes of chronic catarrhal otitis media?

It may follow an acute catarrhal otitis or result from an extension of a similar disease of the naso-pharynx through the eustachian tube. It also results from exposure to cold or wet, or may occur idiopathically in

conditions of lowered vitality. Reflex irritation from carious teeth, syphilis, scrofula, the abuse of alcohol, and hereditary predisposition are occasional factors in the production of this disease; its common cause being the catarrhal affections of the nose and throat.

What is the pathology of chronic catarrhal otitis media?

The pathological changes consist in a swelling of the lining membrane of the tympanum, due at first to venous congestion, but afterward to an actual tissue hypertrophy. The tympanum contains a fluid exudation due either to abnormal activity of the secretory glands or to the transudation of the fluid elements of the blood from the engorged vessels. In the membrana tympani there is thickening of the mucosa and swelling of the fibrous layer, followed by true hypertrophy, and in advanced stages by a deposit of lime salts. The drumhead also exhibits changes in position as well as appearance; when retracted it presents a dimness of color or loss of brilliancy, and reveals to us the changes which have occurred in the middle ear, and which account for the loss of hearing in the individual case. The lumen of the eustachian tube is narrowed and prevents the entrance of air into the middle ear, thereby affecting the integrity of the tympanum.

What are the symptoms of chronic catarrhal otitis media?

Varying deafness, worse in inclement weather or from attacks of coryza; subjective noises in the ear. Tinnitus is a marked symptom, and generally a feeling of discomfort and fullness in the ear is complained of. The patient often hears best in the presence of loud

noises, and is sometimes unaware that the hearing is defective, although in some cases complaint is made that while the sounds are heard, there is an inability to distinguish them in certain cases, as for instance, the voice sounds. Vertigo and occasionally pain are present, usually temporary. Sneezing is not an uncommon accompanying symptom. The external ear and the tissues in immediate connection with the external auditory canal are often sensitive to atmospheric cold, to touch or to pressure.

What is prognosis of chronic catarrhal otitis media?

The course of the disease is usually slow; the variations which occur in the mucous membrane, whether one of proliferation or atrophy, result in changes that cause a retraction of the drumhead, a stiffening of the chain of ossicles and a general impairment of at least the receptive and conductive portions of the ear, which is followed by a progressive loss of hearing.

What is the treatment of chronic catarrhal otitis media?

This depends upon the exciting causes and the character of the affection of the middle ear tissue. The nose and throat should first receive attention and any abnormalities should be corrected by medieal and, if necessary, surgical treatment. In the former the use of sprays for antiseptic cleansing or therapeutic effect, selected with careful consideration for each case, materially assists in relieving the diseased condition. The nasal douche is never advisable. Proper attention should be given to the clothing so as to guard against undue exposure to atmospheric changes. The constitution should be invigorated by hygienic means, exercise,

dietary regulations and other measures instituted by which the body may be rendered insusceptible as far as possible to the deleterious effects of exposure to cold and wet. A dry atmosphere is always desirable, and where practicable a change to a climate of lessened humidity and equable temperature is advisable. Adenoid growths and hypertrophy of the pharyngeal tonsil, when recognized as aggravating or inducing this chronic inflammation of the middle ear, should be removed. The eustachian tube must be kept patulous and the tympanic cavity inflated with air after the method of Politzer. All causes of this disease should be rendered as inactive as possible by appropriate treatment. Homeopathic remedies when thoroughly indicated produce marvelous curative effects. As the remedy must be selected by the general as well as the local symptoms, no special indications can be given. However, prominent among the remedies for excess of secretion, characterized by thickening, hyperemia, and hyperplasia of the mucous membrane, are Baryta muriatica, Calcarea iodata, Calcarea phosphorica, Conium, Ferrum phosphoricum, Gelsemium, Hepar sulphur, Hydrastis, Iodium, Kali muriaticum, Kali hydriodicum, Mercurius, Phytolacca, Pulsatilla, Sanguinaria nitrate, and Tellurium. Among those marked by dryness of the mucous membrane, with atrophy, are Carbo veg., Causticum, Cinchona, Graphites, Iodine, Kali phosphorica, Kali hydriodicum, Magnesia phosphorica, Petroleum, Phosphorus and Silicea.

What is chronic purulent otitis media?

This disease occurs as the result of an infection of

the discharge through atmospheric influences in acute catarrhal otitis media or as a sequel to the acute forms of purulent otitis media when the disease has continued unabated for a period of about three months. The term is often applied to all cases of aural disease in which the discharge from the middle ear has existed for more than two or three months, or even to those cases in which the ear is discharging when the patient presents for treatment. A tubercular and occasionally a specific diathesis may give rise to the affection.

What is the pathology of chronic purulent otitis media?

When a purulent discharge from the tympanum persists for a long period, a certain amount of tissue necrosis takes place. In the early stages the connective tissue alone may be involved, but very soon the osseous structures participate in the process, owing to an interference with their proper blood supply. When the ossicles are involved the incus is usually first to be affected; the process may extend to the walls of the tympanum, although the internal wall is seldom affected. The membrana tympani is perforated in all cases. Secondary involvement of the mastoid process, a grave complication may occur, especially when the external canal is obstructed, the pus finding its way into the pneumatic spaces of the mastoid and producing an osteitis. Cholesteatomata may be formed when the inflammatory process assumes a particular type.

What is the symptomatology of chronic purulent otitis media?

The one prominent symptom is the discharge, and although extensive destruction may have taken place,

this may be the only symptom of which the patient complains. The amount of discharge varies, it may be abundant or so little as to be discoverable only upon inspection of the ear by reflected light. The degree of impairment of hearing is never indicative of the extent of the local process. Attacks of vertigo may occur. Sometimes the discharge ceases for a length of time, to be re-established later, the intermittency depending upon the precise nature of the local changes within the middle ear and also upon certain associated conditions of the upper air tract. The external canal is affected according to the character of the discharge. Exuberant granulations may be found upon the membrana tympani.

What are the dangers of chronic suppuration of the middle ear?

Caries and necrosis of the cochlea may occur, or the suppurative process may invade the mastoid cells, or produce pyemia, cerebral abscess, thrombosis, paralysis and death.

What is the prognosis of chronic purulent otitis media?

If the disease is allowed to take its course, the prognosis is unfavorable, but under skillful surgical and medical treatment the prognosis is often quite favorable if the treatment is continued for the necessary length of time to effect a cure. As to the hearing power, it is impossible to speak definitely as to the amount of hearing obtainable by treatment in any particular case.

What is the treatment for chronic purulent otitis media?

The local treatment is very important, and consists

in cleanliness and the use of the "dry treatment" with the application of remedies in powder or trituration by the use of an insufflator. These powders consist in various proportions of sulphate of zinc, bichromate of potash, salicylic acid, borax, boracic acid, alum ustum, phosphate of lime, calendula, nitrate of sanguinaria or other remedies triturated with some such substance as sugar of milk, or may be used in substance according to the condition present. In general the canal should be first cleansed of all secretion. Attaching a bit of cotton to the cotton-carrier, it is dipped into a 15 volume solution of hydrogen peroxide and the ear swabbed out, after which the canal should be thoroughly dried by means of pledgets of cotton upon the cotton carrier. Then an application of some of the various powders as boracic acid is made with the insufflator and the canal protected by a loose pledget of cotton. Following this, the middle ear is to be inflated by the use of the air-bag or eustachian catheter. In the local treatment it must be kept in mind that there should be at all times a free exit for the pus from the tympanic cavity.

What is the remedial treatment of chronic suppuration of the middle ear?

The prescription of homeopathic remedies which have a proper action upon the conditions of the nose, pharynx and eustachian tube as well as upon the tissues of the middle ear. In the selection of such remedies, no better guide can be found than that furnished by Prof. H. C. Houghton in his Clinical

Otology; the grouping of the indications of the aural remedies being exceedingly valuable.

What are the indications thus given?

Aconitum.—In acute suppuration of the middle ear, or for acute symptoms arising in chronic cases.

Aurum met.—Is indicated in suppurative inflammation of the middle ear when the periosteum of the temporal bone is affected. The subjective symptoms, so far as the ear is concerned, are decidedly negative; but the general ones determine the choice between this remedy and Fluoric acid, Nitric acid, or Silicea.

Baryta muriatica.—Baryta is one of our most valuable remedies, both in suppurative and non-suppurative inflammation of the middle ear. Hardness of hearing, severe buzzing in the ears, crackling in both ears when swallowing, a reverberation in the ear on blowing the nose.

Calcarea carbonica applies to the same class of patients as in general diseases—the fat, rapidly growing, large-headed, soft-boned children, or adults who in youth were vigorous, but now fail from low power of assimilation; great weakness, sensitive to cold, damp air. The pains about the head are pressing or pulsating, often semi-lateral; coldness or perspiration of the head; detonation in the ears; meatus filled with whitish, fetid pus or viscid discharge.

Capsicum.—For chronic suppuration. The pains in and around the ear are acute, shooting, pressing, with bursting headache. On the mastoid, behind the ear, a swelling painful to touch.

Elaps corallinus.—Indicated in the chronic suppurative form of disease, complicated with naso-pharyngeal catarrh; the posterior wall of the pharynx covered with crusts; external meatus full of offensive yellowish-green discharge, which stains the linen green; membrana tympani usually perforated.

Ferrum phos.—Schussler claims that this salt controls the beginning of disease. "Whilst iron restores to their normal condition the blood-vessels, enlarged by disease, it heals the irritative hyperemia, which is the cause of the first stage of all inflammations." This remedy has been called "tissue aconite." One characteristic may guide to its use—beating in the ear and head; the pulse can be counted in the ear, one patient remarked.

Gelsemium.—While this remedy may be more frequently needed in acute disease of the middle ear, it may be specially effective in mastoid disease, or acute necrosis, complicating acute suppuration.

Graphites.—The relation of this remedy to the nutrition of the skin holds good in dry conditions of the mucous membrane; indeed, we may infer very much of the condition of the tympanum from study of the dermoid layer of the external auditory canal. Hence, the condition is that of sclerosis or proliferous inflammation. The membrana tympani may be opaque and thick, or transparent and very thin, adherent to ossicula or promontory, or perhaps mobile; eustachian tube dilatable, but hearing not improved by inflation. There is one subjective symptom which is characteristic —"hearing improved in a noise."

Hepar sulphuris calcarea.—In the suppurative form; membrana tympani perforated; ulceration angry; discharge small in amount, sour, and of fetid odor; the tissue very sensitive, often covered with white shreds, which cling to the ulcer. Subjective symptoms: soreness in small spots about the ear; itching; patient worse at night and by cold air.

Hydrastis canadensis stands first among remedies for muco-purulent discharge from the middle ear. In purulent inflammation of the middle ear, with thick, tenacious discharge, more mucus than pus, this remedy is invaluable.

Iodine.—In chronic, non-suppurative disease. Curative in atrophy of mucous membrane, probably by stimulating glandular elements of structure.

Kali bichromicum.—In chronic suppuration; membrana tympani perforated; the cicatrization of the edges of the perforation complete; the tissues have an appearance as if changed to mucous membrane, and the secretion is often more mucus than pus; the discharge yellow, thick, tenacious, so that it may be drawn through the perforation in strings. The subjective symptoms are lancinations, sticking sensations, that the patients are not able to locate with any degree of positiveness.

Kali muriaticum.—One of the most effective remedies we have ever used for chronic catarrhal inflammation of the middle ear, specially of the form designated "proliferous." Subjective symptoms, a stuffy sensation in the recent cases, subjective sounds, and deafness are very marked. The objective symptoms are, the naso-pharyngeal tonsil, closed eustachian tube, retracted

membrana tympani and atrophied walls of the external meatus.

Kali phosphoricum.—For suppurative disease, specially chronic form. Schussler says: "Potassium phosphate cures the following diseased conditions: septic, scorbutic bleedings, mortifications, encephaloid cancer, gangrenous croup, phagedenic chancre, putrid-smelling diarrhea, adynamic typhoid condition, etc." From the foregoing indications, we are led to use it in ulceration of the membrana tympani, with or without perforation, in suppuration of the middle ear, the pus being watery, dirty, brownish, very fetid, the ulceration angry, bleeding easily, and showing little tendency to granulate, or secrete laudable pus.

Kali sulph.—For catarrhal disease or suppuration, if the discharge be muco-purulent rather than purulent. The guiding symptom is the color of the secretion, which is yellow, sticky and tenacious.

Mercurius dulcis.—In chronic catarrhal inflammation of the middle ear. The objective symptoms are those of this form of inflammation: membrana tympani retracted, thickened and immovable by inflation; a granular or hypertrophied condition of the pharyngeal mucous membrane. The subjective ones are those of a benumbed, dull feeling between the throat and ear, a pressure in the ear from without.

Mercurius solubilis.—Otitis following an exanthemata, and in scrofulous and syphilitic patients, pain in ear, extending to face and teeth, worse by the heat of bed; excoriation and ulceration of meatus; sensitive to cold; abundant secretion of cerumen or flow of pus and

blood; sweating without relief, occurring from cold, when there are hypertrophied tonsils or diseased parotids; pulsative roaring in the affected part; ulceration of the membrana tympani, which bleeds from the slightest touch; constant cold sensation in the ears.

Phosphorus corresponds to a dry condition of the tympanum. One objective symptom, deafness, is interesting in this respect, that the failure is especially for the human voice; noises and musical tones are recognized much more readily than the modulations of voice.

Psorinum.—A remedy closely allied to Sulphur. In chronic suppuration, where the symptoms remain unchanged after Sulphur, the ulcers scab over rapidly; the pus very fetid, with the ulceration of the membrana tympani; scabby ulcers on the vertex and behind the ears. Subjective symptoms: excessive itching in the ears, so that children can hardly be kept from picking or boring in the meatus.

Pulsatilla.—For acute catarrhal inflammation, or chronic suppuration, when the discharge is a bland muco-purulent secretion. Fever without thirst, relief of pains in the open air, and a peevish, changeable, timid disposition, indicating the nervous depression, are guiding symptoms.

Silicea. — In chronic suppuration; ulceration in cachectic subjects, or those who have been dosed with mercury; in caries or necrosis. Objective symptoms: membrana tympani perforated and irregular; secretion of pus scanty; ulcers deep and covered with scabs unless frequently cleansed. More repairs of the mem-

brane occur under the use of this remedy, in chronic diseases, than under any other single remedy.

Sulphur.—The indications for this remedy must be sought in general rather than in special objective ones, as they are meager compared with the last-mentioned remedy as well as others. Itching in the ears, drawing or shooting pains in the ears; discharge of pus, stinking, with crusts.

Tellurium.—Curative in chronic suppuration, when the symptoms correspond to the following: a watery fluid, smelling like fish-pickle, which excoriates the meatus and the skin wherever it flows. After the suppuration has ceased, the membrane has been found cicatrized and corrugated, but not thickened.

Thuja oc.—The special indication for this remedy is the discharge "smelling like putrid meat." Clinically it has cured granulations in the meatus similar to condylomata.

What are the results of chronic suppuration of the middle ear?

Polypi, exostosis, paralysis of the facial nerve, mastoid disease, caries of the temporal bone, phlebitis and thrombosis of the lateral sinus, pyemia, meningitis, cerebral abscess and death.

What are polypi of the middle ear?

Polypi are masses of loose connective tissue cells and blood-vessels which generally arise from exuberant granulations. Granulation tissue developed during the course of a chronic suppuration of the middle ear is very common. The development of masses of sufficient size to be called polypi occurs much less frequently.

Polypi may be either mucous or fibrous in character, but the former are much more common.

What is the treatment of polypi?

The treatment is principally surgical and consists in the removal of the polypus by the snare. The snare is introduced and the wire-loop encircled about the tumor until the pedicle is within its grasp, then the loop is gradually tightened until the tumor is cut through, when the snare is removed and the polypus extracted. If the polypi are very small the application of such caustics as nitrate of silver, chromic acid, bichromate of potash, and resorcin is often sufficient.

What exostosis occurs as a result of chronic middle ear suppuration?

Occasionally a small exostosis may be seen springing from the inner wall of the tympanic cavity in old cases of chronic suppuration of the middle ear. If it becomes of sufficient size the free exit of the pus may be interfered with and the effort to remove a portion of the exostosis by chiseling, or an operation for opening the antrum, should be made.

What aural affection may cause paralysis of the facial nerve?

Paralysis of the facial nerve may occur as the result of caries and necrosis of the inner wall of the tympanum, involving the canal of the facial nerve, although a considerable portion of the facial canal may be opened and the nerve bathed in pus for some time before the symptoms of paralysis are manifested.

What is the prognosis of paralysis of the facial nerve?

The prognosis of paralysis of the facial nerve is as

a rule, favorable if the cause is recognized early and the pressure of the pus in the middle ear relieved.

What is the treatment of paralysis of the facial nerve?

The treatment consists in the use of galvanic and faradic electrical currents as indicated in any form of paralysis and the administration of such homeopathic remedies as may be indicated by the inflammatory condition of the middle ear.

What is mastoid disease?

Mastoid disease or mastoiditis is an inflammation of the mastoid process and cells.

What are the causes of mastoid disease?

Acute or chronic suppuration of the middle ear is the common cause of mastoid inflammation. The cells of the process take on an inflammatory action by extension from the middle ear through continuity of tissue. Syphilis and tuberculosis have been described as causes of mastoiditis.

What are the pathological changes in mastoiditis?

In acute inflammation the lining tissue of the cells presents the characteristics of inflamed mucous membrane. The cells and antrum become filled with pus, and as the secretion increases they become distended, and acute caries and necrosis of the bone rapidly ensues. When the inflammation is less acute the necrosis is often limited in extent; in some cases the cells are obliterated by hypertrophy of the membranous lining of the cells or of their bony walls. Caries or necrosis of the mastoid may by extension

affect the lateral sinus with the production of inflammation, thrombosis and emboli.

What is the course of mastoid inflammation?

In acute suppuration of the middle ear its course is usually very rapid, a few hours or a day or two only intervening between the attack of the middle ear and the involvement of the mastoid. In chronic suppuration of the middle ear the mastoiditis usually occurs as the result of deficient drainage, and its course is, as a rule, not so rapid.

What are the symptoms of mastoid complication?

There is commonly an increase in the pulse and a rise in temperature, the latter often extremely high. There is usually great pain, involving either the side of the head or the whole head. The mastoid process is both painful and tender to touch and the parts behind the ear become swollen and red, and the auricle stands farther out from the head. With the continuance of the inflammation the pain increases and there is restlessness, insomnia, and perhaps vomiting; the patient becomes drowsy or partially unconscious, or passes into a state of coma which is soon followed by death unless the brain complication is relieved.

What is the prognosis of mastoid inflammation?

The prognosis of the affection is always grave except in mild cases where only the periosteum is involved. Where it occurs as an accompaniment of acute suppuration of the middle ear it may be said to run a more favorable course than when it arises from chronic suppuration. The great danger is that the

structures of the brain may be involved and meningitis or cerebral abscess follow. In youth the prognosis may be said to be more favorable than in adult life, as the pressure of the accumulation in the antrum and mastoid cells is more likely to be relieved by the early rupture of the drumhead.

What is the treatment of mastoid disease?

The treatment of mastoid inflammation is prophylactic, medical and surgical.

What is prophylactic treatment of disease of the mastoid?

In acute catarrhal or suppurative inflammation of the middle ear, when there is a bulging of the tympanic membrane due to increased pressure from the secretions in the tympanic cavity, together with pain, tenderness and swelling of the tissues behind the ear, an incision of the drumhead is to be made. If the tissues over the mastoid are red and swollen, or when the pain is intense and located in that region, an incision of the tissues down to the bone as directed by Wilde may be indicated. When the mastoid is involved during the course of chronic suppuration of the middle ear attention must at once be given to any condition of the middle or the external ear which may interfere with the free discharge of pus formed in the tympanic cavity, as well as the use of such treatment which may put the parts as nearly possible in an aseptic condition. Free drainage of purulent secretions from the middle ear being always imperative, if the obstruction is due to dried and impacted secretion or from the presence of polypi, exostosis or necrosed bone, the proper treatment for their removal is to be promptly used.

What is the medical treatment for mastoid disease?

The medical treatment consists in the prescription of such remedies as are indicated for the middle ear affection; the early use of such remedies undoubtedly controls in many cases the mastoid complication and avoids the necessity of operative measures of the mastoid. Belladonna, Capsicum, Ferrum phosphoricum, Hepar sulphur and Silicea or other homeopathic remedies may not only control the destructive processes but hasten the repair of the injured tissue.

What is the surgical treatment of mastoid disease?

In the inception of the attack the application of cold to the mastoid may control the inflammation. When, however, the disease has become established it may be advisable to make Wilde's operation, which consists of an incision made over the mastoid down to the bone, which often relieves the pain and lessens the tension of the outer surface of the bone. When the mastoid has become so affected by the inflammatory process as to preclude the absorption of the contents which cause distension of its cells, or particularly when there is immediate danger or indication of brain symptoms, it becomes necessary to open the mastoid process surgically to relieve the pressure toward the brain and of the middle ear.

How is the operation for opening the mastoid process performed?

The surgeon should be supplied with a strong scalpel, bone-drills, perforators, forceps and curettes, together with small artery-clamps, probes and tissue-retractors, all rendered antiseptic. The patient is

anesthetized and the parts over the mastoid shaved and washed. The operation consists, first, of an incision which divides all the tissues to the bone beginning at a point on a level with, and a little behind, the attachment of the auricle, then carried downward and parallel to it until it has reached a point above the end of the mastoid process, which has been located by the finger. When an incision backward to form a flap is necessary its extent must be determined by the judgment of the operator. The surface of the mastoid must be exposed to such an extent as will enable the use of the bone instruments required for the perforation of the osseous portion of the mastoid. The extent of the drilling, chiseling, gouging and curretting depends upon the condition presented in individual cases. The danger of the operation is that of penetration of the cranial cavity during the operation. The after-treatment is that required on general surgical principles with antiseptics and free drainage.

What relation does caries of the temporal bone bear to chronic suppuration of the middle ear?

In chronic suppuration of the middle ear, if the inflammatory process extends beyond the mucous lining which is intimately connected with the periosteum covering its bony enclosure, and involves the latter, caries begins and may extend directly to the walls of the tympanic cavity and then involve the squamous portion of the temporal bone by continuity of tissue. The tissues over the bone, more often that of its anterior portion, become swollen, red and painful

and the periosteum is often separated by purulent infiltration so that portions of the bone become necrotic.

What is the treatment of caries of the temporal bone?

That which is required for similar conditions affecting other bones. Such remedies as Aurum, Calcarea carbonica, Hepar sulphur, Silicea and Sulphur have here the same curative value as in caries of other bones.

What connection have phlebitis and thrombosis of the lateral sinus to suppurative conditions of the middle ear?

They are possible complications of suppurative middle ear disease and usually follow mastoid implication. The prognosis is always grave, as the condition depends upon the mastoid inflammation, which, when it has involved the smaller veins of the lateral sinus, is usually beyond control.

What are the indications of pyemia complicating middle ear suppuration?

Pus may be taken into the circulation if confined in the middle ear during a chronic suppurative process or when a caries of the bony enclosure of the middle or internal ear is present. The pyemic condition thus set up is indicated usually by a sudden rise in temperature, rigors, and a change in the facial expression of the patient. Purulent infiltration may occur in various portions of the body, and hepatic abscess, phlebitis or pulmonary infiltration result.

What is the relation of meningitis to suppurative inflammation of the middle ear?

In children suffering from acute inflammation of the middle ear the meninges are frequently inflamed,

but clear up with the disappearance of the middle ear inflammation. When, however, the meningitis follows purulent otitis, it is usually suppurative and the patient soon dies from exhaustion or coma.

How does middle ear suppuration cause cerebral abscess?

While it is often difficult to distinguish between suppurative meningitis and cerebral abscess, both affections arise in the same manner from direct or indirect purulent infection from chronic suppuration of the middle ear. When cerebral abscess occurs its location is usually in the temporal lobe of the affected side.

Why is death often a result of middle ear suppuration?

Because of the cerebral complications which may arise from extension of the inflammation to the middle ear.

What is the value of artificial drumheads in perforation or destruction of the tympanic membrane?

In all cases of chronic suppuration, the deafness which remains after the discharge has ceased may often be improved by the use of one of the many artificial drumheads. Their use when non-irritating also affords protection to the tissues of the middle ear, and lessens the tendency to a recurrence of the discharge.

Diseases of the Internal Ear.

What diseases affect the internal ear?

Anemia, hyperemia, inflammation of the labyrinth, Meniere's disease, paralysis of the auditory nerve from concussion or other causes which destroy its function.

What are the causes of anemia of the internal ear?

This condition may depend upon profuse general hemorrhage either from traumatism, from rupture of an aneurism, excessive uterine hemorrhage, or may be a result of simple or pernicious anemia.

What are the symptoms of anemia of the internal ear?

Tinnitus aurium, the subjective sensation of various noises, usually occurs in conjunction with the impairment of hearing, which may be temporary or permanent. The function of audition is impaired through the imperfect nutrition which results from the impoverished blood supply due to the anemia. Attacks of vertigo result from apparently slight causes. The expression of the face is somewhat characteristic, in that it appears dull, abstracted and inattentive. The pallor of the skin or its peculiar ashy-gray color and the blanched mucous membranes are indicative of the accompanying general anemia.

What are the causes of hyperemia of the internal ear?

Hyperemia of the labyrinth may depend either upon a venous stasis from mechanical obstruction to the return current, or upon an increased quantity of arterial blood conveyed to the part. A venous stasis may occur from mechanical obstruction to the great vessels of the neck or from an increased pressure within the thorax temporarily obstructing the passage of blood in the right auricle of the heart, as in severe attacks of coughing or efforts at sneezing and blowing the nose. An increased quantity of arterial blood conveyed to the part may be due to sudden physical exertion, to over-indulgence in alcohol, a diminished elasticity of the

blood-vessels or a sudden diminution of atmospheric pressure. The prolonged action of any one sound, or the condensation of air in the meatus also produces hyperemia of the labyrinth. The condition is prone to occur in individuals of a full habit, and also in those of a gouty or rheumatic tendency.

What are the symptoms of hyperemia of the labyrinth?

An augmentation in the labyrinthine blood supply is characterized by a feeling of fullness and distension in the head, slight giddiness or even vertigo, and the presence of subjective noises, usually of high-pitched character. The impairment of hearing is slight unless the vessel walls suffer; then it may be profound or even absolute, the accompanying giddiness being usually severe and the tinnitus unbearable. In plethoric patients the symptoms are induced or intensified by any cause which increases the blood supply to the head or retards the venous flow.

What is hyperesthesia of the auditory nerve?

An abnormal increase in the audition due to hyperemia of the labyrinth or an increased pressure of the fluids in the labyrinth from affections of the middle ear.

What is aural vertigo?

A disturbance of the sense of equilibrium which occurs from affections of the labyrinth and semicircular canals. It may consist of an unsteadiness of gait, a tendency to fall to one side or the other, and prevent walking from an inability to maintain an erect position.

What is the prognosis in affections of the internal ear?

The prognosis depends upon the location and char-

acter of the affection of the labyrinth, but may be said to be always grave and yet is not always necessarily so. The diagnosis of the part affected and a knowledge of the inflammatory process, may, by the use of homeopathic remedies which are properly administered, be followed by relief of the condition.

What are the causes of labyrinthine inflammation?

Labyrinthine inflammation may result from concussion of the head from blows or falls, the effect being communicated to the internal ear or labyrinth. Such diseases as cerebro-spinal meningitis and mumps, inflammatory extensions from the middle ear to the labyrinth in scarlet and typhoid fevers, and acute or chronic suppurations of the middle ear, furnish a large number of the internal ear diseases which, from their invasion of the labyrinth, destroy the hearing, and in young children produce deaf-mutism. The labyrinth may be affected by injuries or diseases of the middle ear, especially in children.

What are the symptoms of inflammation of the labyrinth?

There is usually sudden loss of hearing with marked vertigo and more or less tinnitus. In one form occurring in children there is usually some feverishness, vomiting, delirium, and sometimes convulsions. In a few days the child recovers, but the hearing is totally lost and the child's gait very unsteady.

What is Meniere's disease?

In Meniere's disease there is sudden loss of hearing with intense vertigo followed by vomiting, a ringing tinnitus and inability to walk. The attack is supposed to be due to hemorrhage in the labyrinth.

What is the treatment of labyrinthine disease?

As a rule but little can be accomplished by treatment of any kind. Kali iodidum, Mercurius, Belladona, Hepar and Silicea have cured some cases.

What is hysterical deafness?

A symptom, usually the accompaniment, of hysterical conditions. It is commonly unilateral and may affect either ear. The loss of hearing is apparently complete and may last for a few hours, or for days.

What is deaf-mutism?

A condition of deafness or impaired hearing due to imperfect development or disease of the ear accompanied by loss of speech.

What general diseases affect the ear?

Affections of the nose and throat bear a very close relation to diseases of the ear. Scarlatina, measles, diphtheria and dentition, however, furnish the most frequent causes of acute and chronic suppurative inflammation of the ear. Typhoid fever, pneumonia and acute bronchitis are frequently complicated by aural affections. Pertussis and parotiditis are frequently accompanied by inflammation of the middle ear. Diseases of the central nervous system, as well as those of the sexual system, are less likely to cause ear affections than those of the eye. Meningitis, particularly when cerebro-spinal often implicates the internal ear.

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